



Annual Report 2015



Anti Malaria Campaign

Annual Report 2015



Anti Malaria Campaign
Ministry of Health



Anti Malaria Campaign

No. 555/5 ,
3rd Floor,
Public Health Building,
Narahenpita,
Sri Lanka.

Telephone : +94 11 58408/2368173/2368174

Fax : +94 11 2 368 360

e-Mail : antimalariacampaignsl@gmail.com

Website : <http://www.malariacampaign.gov.lk>

2015

Contributors

Dr Hemantha Herath, Director, Anti Malaria Campaign

Dr Risintha Premaratne, Deputy Director, Anti Malaria Campaign, National coordinator for WHO malaria free certification

Dr Devani Ranaweera, Consultant Community Physician, Anti Malaria Campaign

Dr Manjula Danansuriya, Consultant Community Physician, Anti Malaria Campaign

Dr I E Gunaratne, Senior Registrar, Community Medicine, Anti Malaria Campaign

Dr M Marasinghe, Registrar, Community Medicine, Anti Malaria Campaign

Dr Hamsananthy Jeevatharan, Registrar, Community Medicine, Anti Malaria Campaign

Dr N Saravanabavan, Registrar, Community Medicine, Anti Malaria Campaign

Dr Priyani Dharmawardena, Medical Officer, Anti Malaria Campaign

Dr L R Gunasekara, Medical Officer, Anti Malaria Campaign

Dr P H P D Somaratne, Medical Officer, Anti Malaria Campaign

Dr U Tittagala, Registered Medical Officer, Anti Malaria Campaign

Ms Kumudu Gunasekera, Parasitologist, Anti Malaria Campaign

Ms Mihirini Hewavitharane, Entomologist, Anti Malaria Campaign

Ms Jeewani Harishchandra, Entomologist, Anti Malaria Campaign

Staffs/Statistic Unit, Anti Malaria Campaign

Regional Malaria officers and staff

Project Director and staff, GFATM Project, Ministry of Health

Texts were compiled by Anti Malaria Campaign Team

Supervised by Director, Anti Malaria Campaign

Contents	Page No.
Table and Figures	6
Foreword	8
Acknowledgement	9
Introduction	10
Epidemiology	12
Parasitological surveillance	16
Vector surveillance	20
Vector Control Activities	34
Infrastructure and Human Resources	36
Foreign Funded Projects	39

Table and Figures

Tables		Page No.
Table 1	Proportion of <i>P. falciparum</i> , <i>P. vivax</i> and <i>P.ovalae</i> infections during the last 10 years (2006- 2015)	13
Table 2	Distribution of imported cases by type and country of origin during 2015	14
Table 3	Total number of blood smears screened among the districts during the year 2015	17
Table 4	Distribution of regional QA/QC laboratories during the year 2015	18
Table 5	Total number of entomological surveillance days spent by central and regional entomological teams	21
Table 6	Susceptibility status of <i>An. culicifacies</i> to different insecticides	33
Table 7	Susceptibility status of <i>An. subpictus</i> to different insecticides	33
Table 8	Insecticides usage in different districts for indoor residual spraying during 2015	34
Table 9	Distribution of Long Lasting Insecticides Treated Nets (LLIN) for Malaria Control during 2015	35
Table 10	Staff position at Anti Malaria Campaign Headquarters during the year 2015	36
Table 11	Vehicles available at Anti Malaria Campaign Headquarters	37
Table 12	Distribution of anti malarial drugs from headquarters by recipient	38

Figures		Page No.
Figure 1	Number of blood smears examined among districts during the years 2014 and 2015	12
Figure 2	Reported districts of Imported malaria cases during the year 2014/2015	13
Figure 3	Propotion of Imported malaria cases by country of origin during 2015	14
Figure 4	Map showing distribution of sentinel sites by hut locations in 2015	22
Figure 5	Results of larval surveys showing the relative density of major malaria vector larvae and secondary vector larvae in different breeding habitats	23
Figure 6	Mean number of larvae of malaria vectors in different districts during the year 2015	24
Figure 7	Mean density of malaria vector females caught in cattle baited hut collections in different districts 2015	26
Figure 8	Map depicting mean density of major vector adults caught by cattle baited huts in 51 MOH areas	27
Figure 9	Mean density of malaria vector females caught in cattle baited trap collections in different districts during 2015	28
Figure 10	Indoor resting densities of <i>Anopheles culicifacies</i> and <i>Anopheles subpictus</i> in RMO Regions	29
Figure 11	Percentage of human biting preferences of Anopheles species caught during partial night human landing catches	30
Figure 12	Monthly trends of <i>Anopheles culicifacies</i> human biting rates in 18 RMO regions	31

Foreword

The Anti Malaria Campaign of the Ministry of Health, Sri Lanka is presenting the Annual Report on Malaria Elimination Programme for the year 2015. The Programme is responsible for the prevention of resurgence of malaria and to ensure malaria free Sri Lanka.

Anti Malaria Campaign is having public health service network through regional malaria offices and linkages with curative health sector for the treatment services. It is the third year without the indigenous malaria in Sri Lanka. The programme is continuing the vigilant case surveillance for imported cases. Rapid Response Team is responsible to take immediate investigations when a suspected malaria case is reported. Notification of malaria to Anti Malaria Campaign (AMC) is mandatory through telephone within 24 hours. AMC will confirm the diagnosis by malaria microscopy. Medicines for malaria treatment will be provided by the AMC. Each diagnosed case of malaria is reviewed and entomological and parasitological investigations are done in the field. Routine entomological and parasitological surveillance are also carried out to strengthen the programme.

The report will facilitate programme managers to construct the policies and strategic plans to progress towards the goal as 'Malaria free Sri Lanka' in future.

Dr H D B Herath

Director

Anti Malaria Campaign

Acknowledgements

This report provides the progress of National Malaria Elimination Programme for the year 2015. Anti Malaria Campaign (AMC) is grateful to all the stakeholders of the Programme. The support given by the Government of Sri Lanka, Ministry of Health is highly appreciated and it is the sustained strength that had made the programme grow over the century.

The continuous technical inputs given by the Professionals from the technical support group should always be appreciated. AMC is extremely in debt for the Technical as well as the financial supports offered by the development partners; World Health Organization, Global Funds for Fight against AIDS, Tuberculosis and Malaria (GFATM), Tropical and Environment Disease Health Associates (TEDHA) and Lanka Jathika Sarvodaya Shramadana Sangamaya of Sri Lanka.

Consultant Community Physicians, Staff from entomological and parasitological unit need to be thankfully remembered for their inputs. The public health staff from all over the country who have always made immense efforts should be highly regarded. Staff of the statistic unit to be honoured for the effort they have taken to make the data management.

Introduction

Considerable progress has been made against malaria since the beginning of the century with drastic decreases in cases and no indigenous case of malaria being reported since October 2012. Anti Malaria Campaign has been able to control indigenous transmission of malaria during the year 2013 to 2015.

Currently, the biggest threat to the elimination efforts is the risk of resurgence due to imported malaria and the continuing receptivity in several parts of the country due to the persistence of malaria vectors and over the past six years, most of the imported malaria cases were being reported from foreign travellers or Sri Lankan national returning from malaria endemic countries. With enhanced parasitological surveillance, 36 cases were reported in 2015 compare to 49 in 2014. The implications of the imported cases are discussed in the context of the challenges faced by the Anti Malaria Campaign (AMC) and measures taken to prevent the reintroduction of malaria.

The activities of Anti Malaria Campaign is according to the National Malaria Strategic Plan for Elimination and Prevention of Re-introduction 2014–2018, with the new vision ,mission , objectives and strategies as follows;

Vision

A Malaria Free Sri Lanka

Mission

Plan and implement a comprehensive programme to sustain intensive surveillance and outbreak preparedness, prevention and rapid response for malaria elimination in Sri Lanka and to prevent re-introduction of malaria to Sri Lanka.

Objectives of the Anti-Malaria Campaign

To sustain malaria free status by prevention of re-introduction of malaria to Sri Lanka

To obtain WHO certification of malaria elimination in Sri Lanka by the end of 2016

To maintain zero mortality due to malaria in Sri Lanka

Strategic approaches:

- Guarantee all people have access to early case detection through reliable and accurate diagnostic services and prompt and effective treatment through strengthening of surveillance for malaria case detection;
- Guarantee that health care staff are competent and maintain skills and quality diagnostic services to detect malaria cases early and to provide effective treatment to prevent deaths due to malaria;
- Improve systems for outbreak forecasting, preparedness, prevention and response; and
- Ensure the use of other appropriate and selective vector control methods with the aim of reducing local vector populations by strengthening of entomological surveillance and response through integrated vector control.

Strategies

- Establishing a rigorous Quality Assurance programme for malaria elimination to ensure that cases are not being missed and interventions are carried out as planned with a view to ensure that malaria is not re-introduced in to the country.
- Strengthening Information, Education and Communication activities so as to strengthen intersectoral collaboration for malaria elimination and to strengthen the knowledge within communities.
- Improving programme management and performance to build capacity to ensure prevention of re-introduction of malaria in the country.
- Engaging in operational and implementation research so as to provide evidence based guidance for future modifications of malaria elimination policies/strategies.
- Monitoring and evaluation to ensure optimal programme implementation, management and performance which is a key element in obtaining performance based funding.

Epidemiology

Sri Lanka has reached the elimination status as there is no indigenous malaria cases since October 2012 and currently in the prevention of re-introduction phase.

A total number of 1,142,466 blood smears were examined during 2015 for the purpose of detection of malaria parasites by the departmental staff attached to the medical institutions and the Anti Malaria Campaign including its regional offices. Figure 1 shows the number of blood smears examined among districts during the years 2014 and 2015.



Figure 1: Number of blood smears examined among districts during the years 2014 and 2015

Following this screening, there were no indigenous malaria cases reported. Although 36 imported malaria cases were detected. This included 17 *P. vivax* infections, 17 *P. falciparum* infections and 2 *P. ovalae* infection.

Year	Total cases	P. vivax		P. falciparum		Mixed		Other	
		No	%	No	%	No	%	No	%
2006	591	564	95	18	3.0	9(mixed)	1.9		
2007	198	191	96.4	6	3	1(mixed)	0.6		
2008	670	623	93	29	4.3	17(mixed)	2.5	1(P.m)	0.1
2009	558	529	95	21	3.8	8(mixed)	1.2		
2010	736	704	95.3	17	2.3	14(mixed)	2.2	1(P.m)	0.1
2011	175	158	90.3	12	6.8	5(mixed)	2.6		
2012	93	45	48.3	42	45.2	4(mixed)	4.3	2(P.o)	2.2
2013	95	52	54.7	42	44.2			1(P.o)	1.0
2014	49	28	57.1	20	40.8			1(P.m)	2.0
2015	36	17	47.2	17	47.2			2 (P.o)	5.5

Table 1: Proportion of *P. falciparum* , *P. vivax* , *P.ovale* and *P.malariae* infections during the last 10 years (2006 - 2015)

Imported malaria cases

36 imported malaria cases from other countries were reported (17 *P. vivax* infections, 17 *P. falciparum* and 2 *P.ovale* infections). The number of imported malaria cases detected during this year, shows a decrease when compared with the year 2015. Majority of cases were imported from India. Figure 2 shows the district-wise comparison between the number of imported cases reported in the country in year 2014 and 2015. Majority of cases were reported from western province.

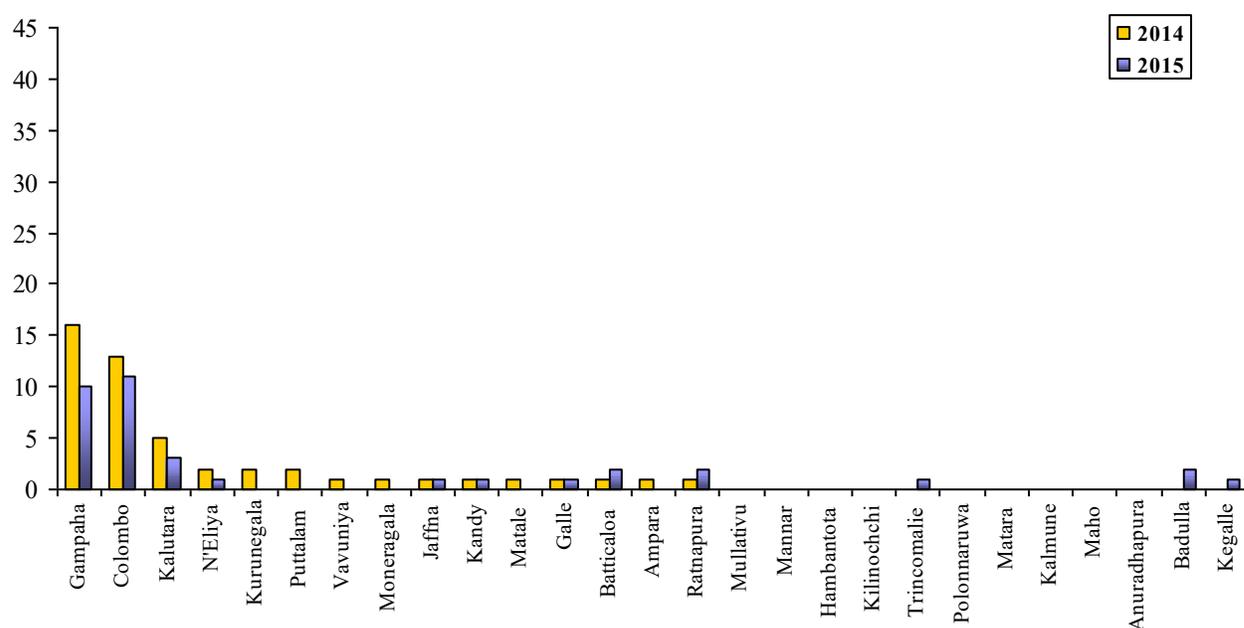


Figure 1: Reported districts of imported malaria cases during 2014/2015

The imported cases had been reduced from 49 cases in 2014 to 36 cases in 2015. Majority of cases (47%) were imported from African region (50%) and South East Asia region (Figure 3). Table 3 shows the type of infection by the country of origin.

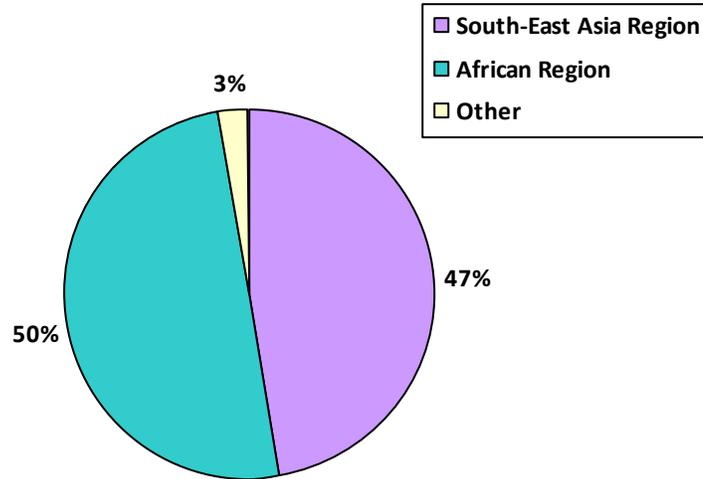


Figure 3: Proportion of Imported malaria cases by country of origin during the year 2015

Country	2015			
	Total positive	<i>Pv</i>	<i>Pf</i>	<i>Po</i>
Central Africa	4		4	
Ghana	1		1	
India	14	13	1	
Ivory Coast	1		1	
Liberia	2		0	2
Madagascar	1		1	
Mozambique	2		2	
Nigeria	2		2	
Pakistan	3	3	0	
Saudi Arabia	1	1		
South Africa	1		1	
Sudan	3		3	
Tanzania	1		1	
Total	36	17	17	2

Table 2: Distribution of imported cases by type and country of origin during 2015

Chemoprophylaxis

The Anti Malaria Campaign provided chemoprophylaxis to travellers to malaria endemic countries based on WHO guidelines. AMC headquarters has provided chemoprophylaxis for 1013 persons during the year 2015. Mefloquine (6495 tablets) and Chloroquine (535 tablets) were issued to them depending on the country they visited. Majority of these travelers were males and above 18 years old.

Mortality

When compared with other South-East Asian countries, mortality due to malaria in Sri Lanka is extremely low. No deaths due to malaria were reported since the year 2008.

Information management

All the monthly returns from regional malaria offices were computerized in the central information management unit at AMC/HQ.

Network facilities were already established between the Anti Malaria Campaign Headquarters and the Regional Malaria Offices with the assistance of the Global Fund. Information regarding positive cases was transmitted to AMC Headquarters through hotline and a web based system established at AMC Headquarters. Furthermore, all malaria cases and potential vector breeding sites were mapped with the GIS.

To enhance the case surveillance from the private sector, communication cell at the AMC Headquarters was maintained with the assistance of Global Fund.

Prevention and control of epidemics/outbreaks

The following strategies are used to forecast epidemics.

- Regular observation of fever incidence/ and malaria morbidity in Medical Institutions.
- Monitoring of vector densities (larval and adult) in sentinel stations and by random spot checks.
- There were no epidemics reported in the year 2015.

Status of drug resistance and drug policy

All the *P. falciparum* and *P. vivax* positive patients were followed-up for one month to detect resistant strains of the parasite to artemether-lumefantrin and chloroquine respectively. There were no resistant *P. falciparum* and *P. vivax* cases detected during year 2015.

Programme priorities

Prevention of re-introduction of malaria cases has been identified as the priority. Malaria prevention among security forces getting training in African countries and Haiti, Sri Lankan returnees from India, refugees and asylum seekers were considered as risk group and clinician awareness programme to early diagnosis and treatment is identified as priority during the year 2015.

Parasitological Surveillance

The Parasitological Surveillance in the country is implemented mainly through screening of individuals attending to medical institutions and village level screening done in malarious localities. Screening done at medical institutions is categorized as Passive Case Detection (PCD) which included medical institutions where there is no Public Health Laboratory Technician (PHLT)/ Public Health Field Officer (PHFO) or Activated Passive Case Detection (APCD) which includes medical institution where there is either a PHLT and/or a PHFO. Village level screening is done by Active Case Detection (ACD) and Mobile Malaria Clinics. Microscopy is the main diagnostic method while Rapid Diagnostic tests (RDTs) are also being used as a supplementary tool.

Screening of suspected malaria patients

In 2015, a total of 1142466 blood smears were examined by the Public Health Laboratory Technicians attached to Anti Malaria Campaign. District wise distribution of blood smears done is given in table 3.

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
Ampara	2224	2264	2253	1946	2155	2285	2372	2264	2322	2459	2321	2748	27613
Anuradhapura	6728	6386	6128	5586	7254	6918	7329	6669	6696	6472	5940	5540	77646
Badulla	3221	3350	4340	3817	4843	4057	4254	4089	4029	4256	4098	4145	48499
Batticaloa	3598	2877	4214	2997	4155	3982	3715	3817	5311	4250	3965	3800	46681
Colombo	5888	5410	6519	6296	8367	7006	8047	7535	6449	7724	6681	7974	83896
Embilipitiya	2660	3185	3544	3281	4048	4139	3957	3992	4104	4072	3764	4177	44923
Galle	1317	1722	1479	1341	1524	1944	1789	1811	1823	1818	1591	1995	20154
Gampaha	2634	4822	3825	3105	4008	3919	3321	3741	4484	5728	4460	3679	47726
Hambantota	2084	2231	2649	988	2686	2087	3134	1508	1741	2557	1557	1710	24932
Jaffna	7892	6228	6938	5216	6288	6307	6038	5789	6293	6546	5828	6725	76088
Kalmune	4045	3352	3967	2773	2832	3081	2849	3031	3248	3351	2862	3599	38990
Kalutara	1218	1840	1750	1398	2022	1092	1580	1652	1385	1332	1758	2255	19282
Kandy	3822	3544	3923	3412	3919	4248	4020	4826	4379	4366	4708	4179	49346
Kegalle	2557	3134	2859	2404	3456	3393	3199	3627	3484	3746	3462	3612	38933
Kilinochchi	4322	3880	3641	2456	5224	5494	5449	3971	3705	4183	3583	3931	49839
Kurunegala	5097	6251	6569	5173	6511	6756	6835	6211	6761	6250	6759	6626	75799
Maho	1962	1758	1760	1616	2457	2822	2248	2096	2320	2452	2655	2272	26418
Mannar	4016	4256	4112	2713	3028	3408	3647	3481	3951	4393	4386	4560	45951
Matale	2775	2534	2836	2144	2779	2662	2592	2579	2550	2994	2737	2897	32079
Matara	1517	1593	1883	1536	2057	1237	1605	1761	1886	2707	2351	2139	22272
Moneragala	3914	3900	2529	3580	3892	3900	6864	3793	4213	4589	4369	4737	50280
Mulativu	3767	3382	3853	3731	3176	3887	3162	3028	1638	2158	1961	3024	36767
Nuwara eliya	265	267	612	138	394	357	292	291	266	261	320	272	3735
Polonnaruwa	3692	4286	4329	3076	4004	4332	4862	3873	4042	4237	3749	3987	48469
Puttalam	2388	2168	3203	2224	3312	2957	2590	2545	3131	2486	2181	2526	31711
Trincomalee	2127	2431	2420	2096	2100	1932	2442	2690	2296	2101	2396	3187	28218
Vavuniya	4094	3987	4207	4024	4217	4662	3771	3056	4294	3244	3252	3411	46219
Total	89824	91038	96342	79067	100708	98864	101963	93726	96801	100732	93694	99707	1142466

Table 3: Total number of blood smears screened among the districts during the year 2015

Activities related to quality assurance of malaria microscopy

The Standard Operating Procedures for malaria microscopy which were prepared with the assistance of ACTMalaria, became effective from 01.01.2015.

QA/QC PHLTT and PHLTT attached to regional laboratories were trained on the proper preparation and collection of blood smears and Quality Assurance and Quality Control of malaria microscopy in March 2015.

Twenty-one regional laboratories attached to Regional Malaria Offices were upgraded as Regional QA/QC laboratories (details are given in table 4) by providing equipment related to preparation of buffered distilled water and commencing quality assurance and quality control of malaria microscopy at regional level.

Province	RMO Regions/Districts where equipment for QA/QC Laboratories were given	Districts where QA/QC PHLT or another technician is trained on use of equipment
NP	Jaffna	1 PHLT trained
	Kilinochchi	1 PHLT trained
	Mulativu	Kilinochchi QA/QA to cover
	Mannar	Anuradhapura PHLT to cover
	Vavuniya	1 PHLT trained
NCP	Anuradhapura	1 PHLT trained
	Polonnaruwa	1 PHLT trained
NWP	Kurunegala	1 PHLT trained
	Maho	1 PHLT trained
	Puttalam	1 PHLT trained
CP	Kandy	1 PHLT trained
	Matale	1 PHLT trained
SBP	Kegalle	1 PHLT trained
	Embilipitiya	1 PHLT trained
UP	Badulla	1 PHLT trained
	Moneragala	1 PHLT trained
SP	Hambantota	1 PHLT trained
EP	Trincomalee	1 PHLT trained
	Batticaloa	1 PHLT trained
	Ampara	1 PHLT trained
	Kalmune	1 PHLT trained

Table 4 Distribution Regional QA/QC laboratories during 2015

In addition, Standard Operating procedures were prepared for performance and interpretation of malaria rapid diagnostic test kits provided by Anti Malaria Campaign. The PCR laboratory became functional in August 2015 and renovation work was initiated in November 2015 .

Special parasitological surveillance activities carried out by the Anti Malaria Campaign

During the year 2015, the Anti Malaria Campaign conducted special screening programmes at the Bandaranaike International Airport to screen military personnel returning from UN peace keeping missions and special groups returning from malaria endemic countries when informed by IOM and UNHCR. In addition, special risks groups were also screened.

Vector surveillance

Entomological surveillance played a vital role in monitoring the vector densities throughout the country despite the setting of malaria free status in the country during 2015. The routine entomological monitoring at the sentinel sites was continued in the previous malaria endemic areas, whereas random spot checks were conducted in receptive and vulnerable areas and malaria case based entomological investigations were carried out in areas where imported malaria cases had been reported.

Thirty eight entomological teams engaged in the entomological surveillance activities and the number of teams was increased in the latter part of the year according to the National Strategic Plan 2014-2018. Entomological investigations were carried out according to the guidelines for malaria entomological surveillance of AMC. A total of 907 entomological surveys were carried out throughout the year as 569 sentinel surveys 338 and spot surveys. The number of days spent for entomological activities are given in Table 1. and a total of 4248 days were spent by the central and regional entomological teams in 2015.

The number of sentinel sites monitored was 53 in 51 MOH areas. Figure 1. shows the distribution of sentinel sites given by the cadjan hut locations of cattle baited hut trap technique. The malaria case based entomological surveys were expanded by carrying out investigations for each malaria case (imported) including in the western province and Galle and Matara districts.

Two semiannual review meetings were conducted at national level to review the entomological surveillance activities carried out at regional level in 2015.

District	No. of entomological days
Ampara	110
Anuradhapura	211
Badulla	165
Batticaloa	110
Hambantota	377
Jaffna	121
Kalmunai	190
Kandy	199
Kegalle	195
Kilinochchi	144
Kurunegala A	171
Kurunegala B	244
Maho	195
Mannar	117
Matale	161
Moneragala	234
Mullative	126
Polonnaruwa	191
Puttalam	131
Ratnapura	239
Trincomalee	216
Vavuniya	121
AMC HQ	280
Total	4248

Table 5. Total number of entomological surveillance days spent by central and regional entomological teams

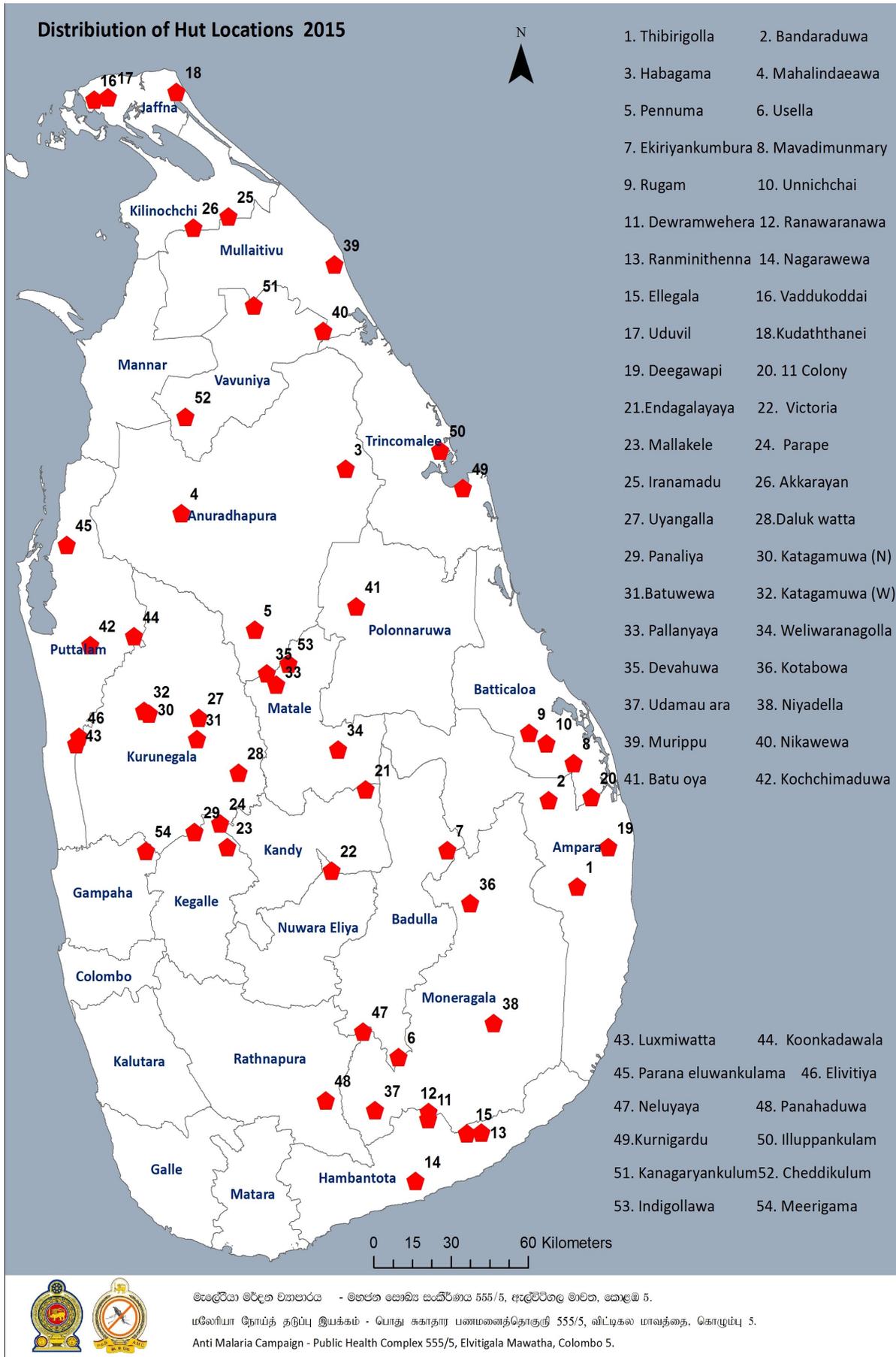


Figure 4. Map showing distribution of sentinel sites by hut locations in 2015

The results of the entomological surveys acquired in 2014 are as follows.

Larval surveys

Larval surveys were conducted in all sentinel sites, spot investigations and malaria case based investigations to monitor larval densities and breeding site preferences of malaria vector mosquitoes.

Figure 5 shows the results of larval surveys carried out in all RMO regions showing breeding habitat preferences of major malaria vector and secondary vectors. Larval surveys during 2015 indicate that the highest density of *Anopheles culicifacies* was found in river bed pools.

Wells, river and stream margins and temporary water collections are the other three main types of breeding sites which contributes to breeding of *Anopheles culicifacies* respectively. The main breeding sites of secondary malaria vector *Anopheles subpictus* are lagoons and marshy lands, tank margins and temporary water collections. Main breeding sites of *Anopheles varuna* is river and stream margins while *Anopheles annularis* was abundant in tanks.

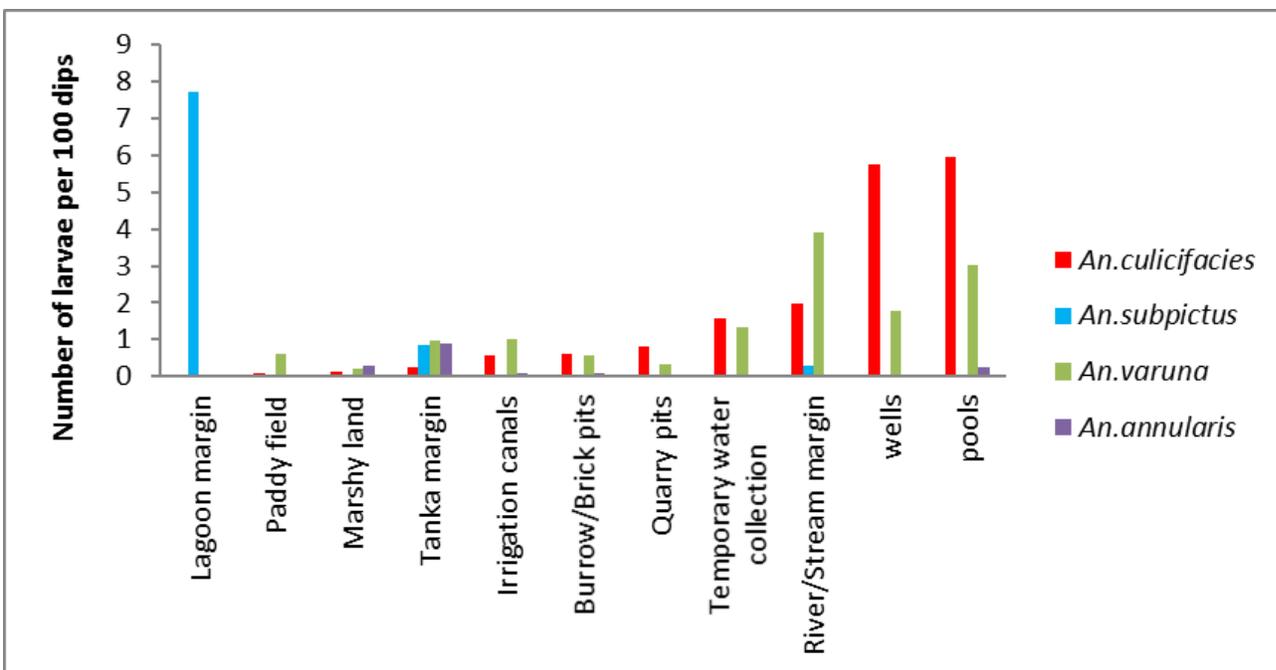


Figure 5: Results of larval surveys showing the relative density of major malaria vector larvae and secondary vector larvae in different breeding habitats

Larval Densities of malaria vectors

Figure 6 shows the mean densities of *Anopheles culicifacies* larvae in different districts where larval sampling has been carried out. Kegalle district of Sabaragamuwa province and Badulla district of Uva province recorded the lowest densities of *Anopheles culicifacies* larvae while localities of Nuwaraeliya district has recorded the highest densities of *Anopheles culicifacies* larvae.

Comparison of larval densities of major vector and the secondary vectors by the districts is shown by figure 6. Mannar had the highest densities of vector larvae while Nuwaraeliya, Maho and Trincomalee had the subsequent highest larval densities. Highest densities of *An. culicifacies* larvae was recorded from Nuwaraeliya, Maho and Trincomalee districts, whereas highest densities of *An. subpictus* was recorded from Kilinochchi and Mannar districts.

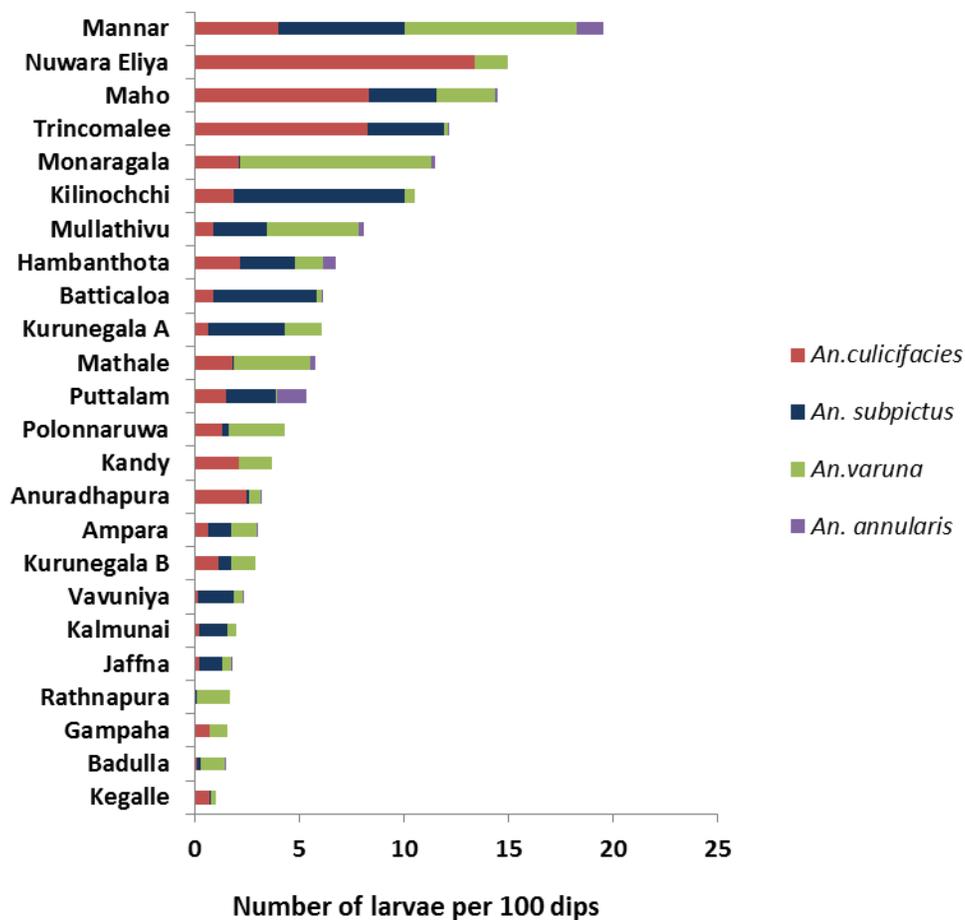


Figure 6: Mean number of larvae of malaria vectors in different districts during the year 2015

In 2015 larval surveys has been carried out in 170 MOH areas out of 332 MOH areas and the respective densities are shown in Table 6. The highest density of *Anopheles culicifacies* was recorded from the Bingiriya MOH area of Kurunegala B RMO region while second highest density was recorded from Thanamalwila MOH area of Moneragala RMO Region. Out of the surveyed MOH areas *Anopheles culicifacies* larvae has not been detected from 46 MOH areas during the surveys.

Cattle Baited Hut Collections

Results of cattle baited hut technique is often used as an indicator for prevalence of indoor biting and resting vector populations. Figure 7 depicts the abundance of adult major malaria vector and secondary vectors in 22 RMO regions in 2015. Maho region of Kurunegala district recorded the highest density of adult females caught *An. culicifacies* in cattle baited cadjan huts followed by Batticaloa and Moneragala. Highest density of *An. subpictus* was recorded by Batticaloa followed by Hambanthota, Maho and Kalmunai. *An. varuna* and *An. annularis* was recorded in low densities in cattle baited huts in 2015.

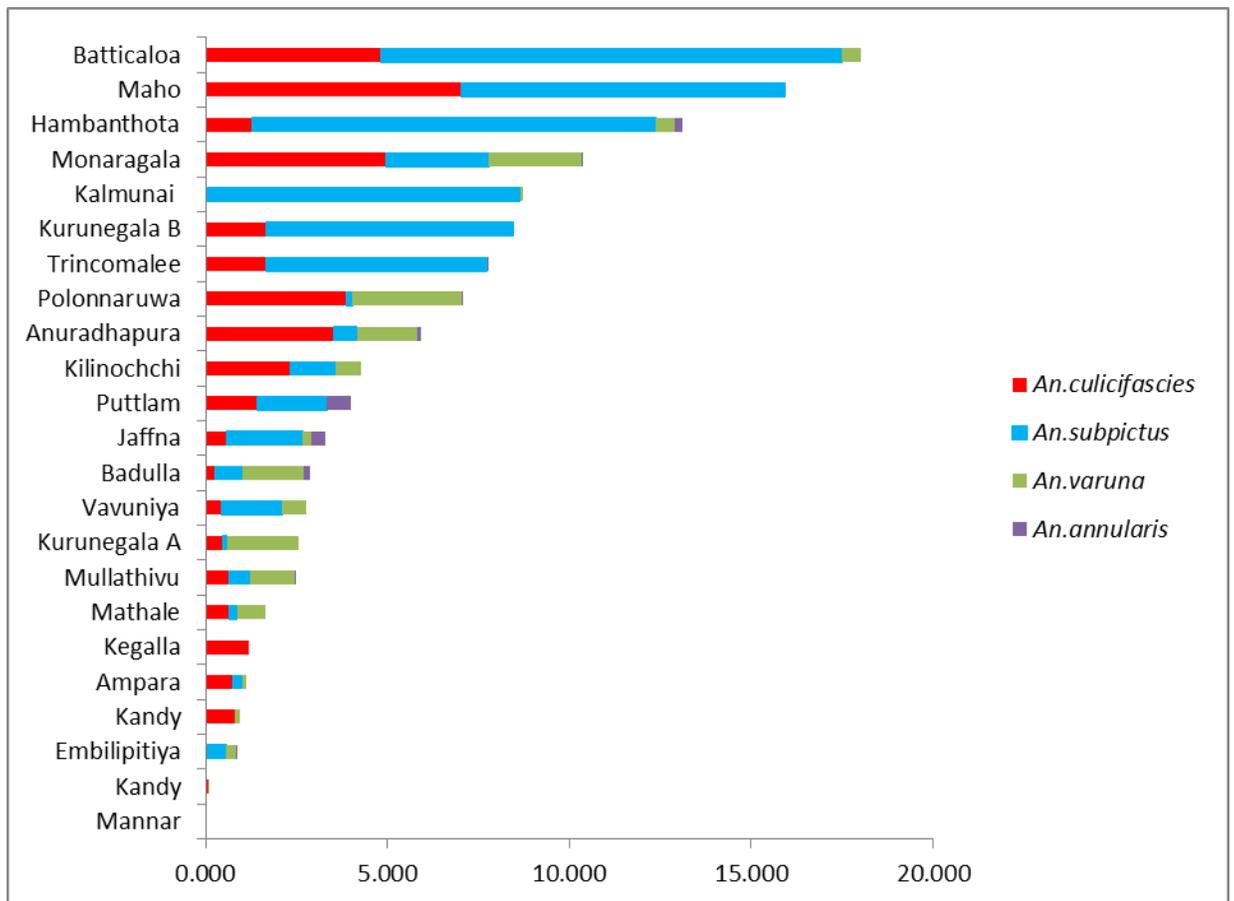


Figure 7. Mean density of malaria vector females caught in cattle baited hut collections in different districts 2015.

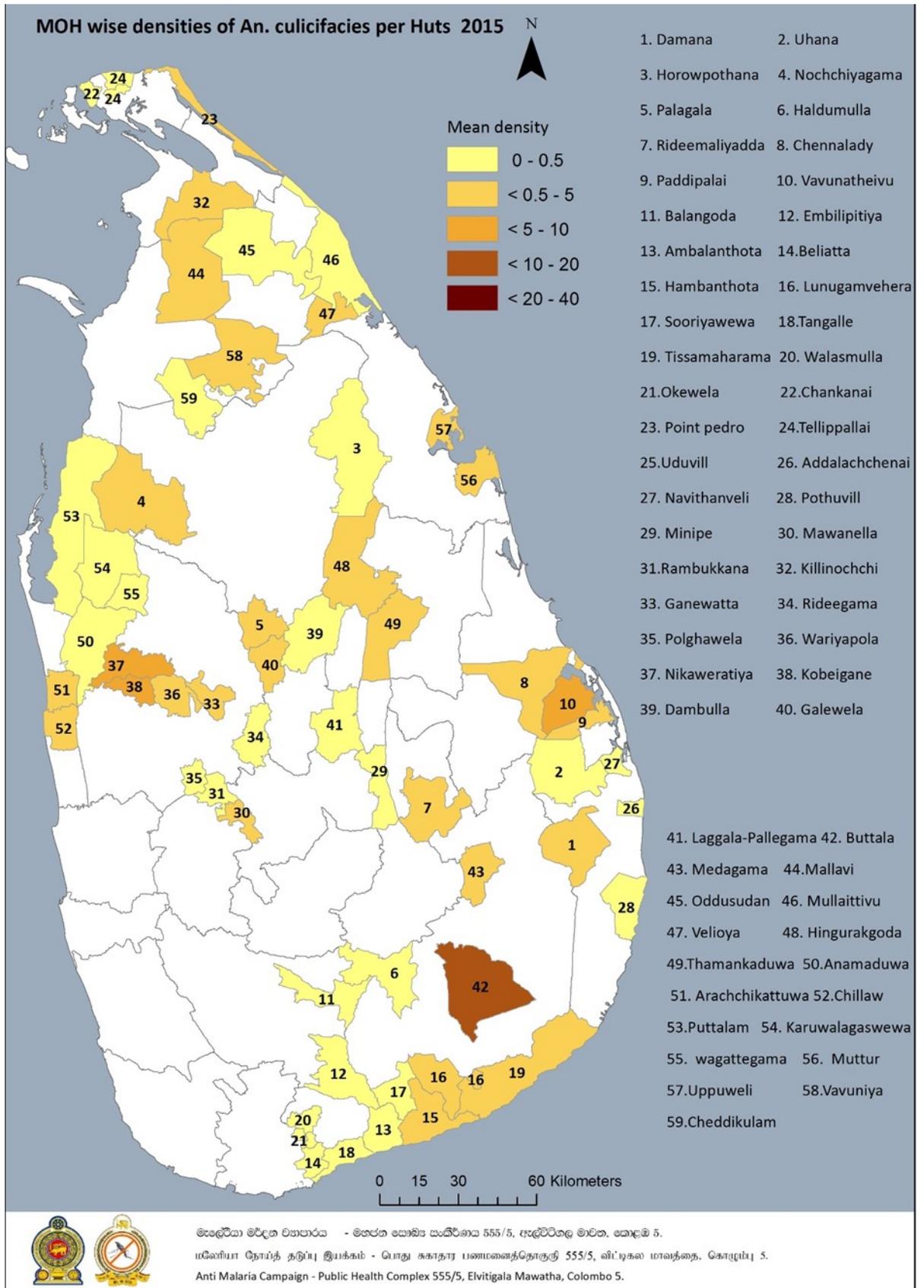


Figure 8: Map depicting mean density of major vector adults caught by cattle baited huts in 51 MOH areas

Table 8 shows the mean density of major vector adults caught by cattle baited huts in 51 MOH areas which were considered as sentinel MOH areas. Buttala MOH had the highest mean adult female density of *Anopheles culicifacies* having a density of more than 10 females per hut. However, this is a marked decline in adult female densities of *Anopheles culicifacies* when compared to the previous years. Nikaweratiya and Vavunathivu recorded a density of 5-10 mean number of adult females per hut.

Cattle Baited Trap Collections 2015

Results of cattle baited hut technique is often used as an indicator for prevalence of outdoor biting *Anopheles* mosquito populations.

Figure 9 depicts the abundance of adult major malaria vector and secondary vectors caught cattle baited trap collections in 22 RMO regions in 2015. Moneragala district recorded the highest density of adult females vectors in cattle baited traps followed by Batticaloa and Jaffna districts. Highest density of *An. subpictus* was recorded by Moneragala district followed by Jaffna district. *An. varuna* and *An. annularis* was recorded in low densities and *Anopheles culicifacies* was found in very low densities in cattle baited trap net collections in 2015.

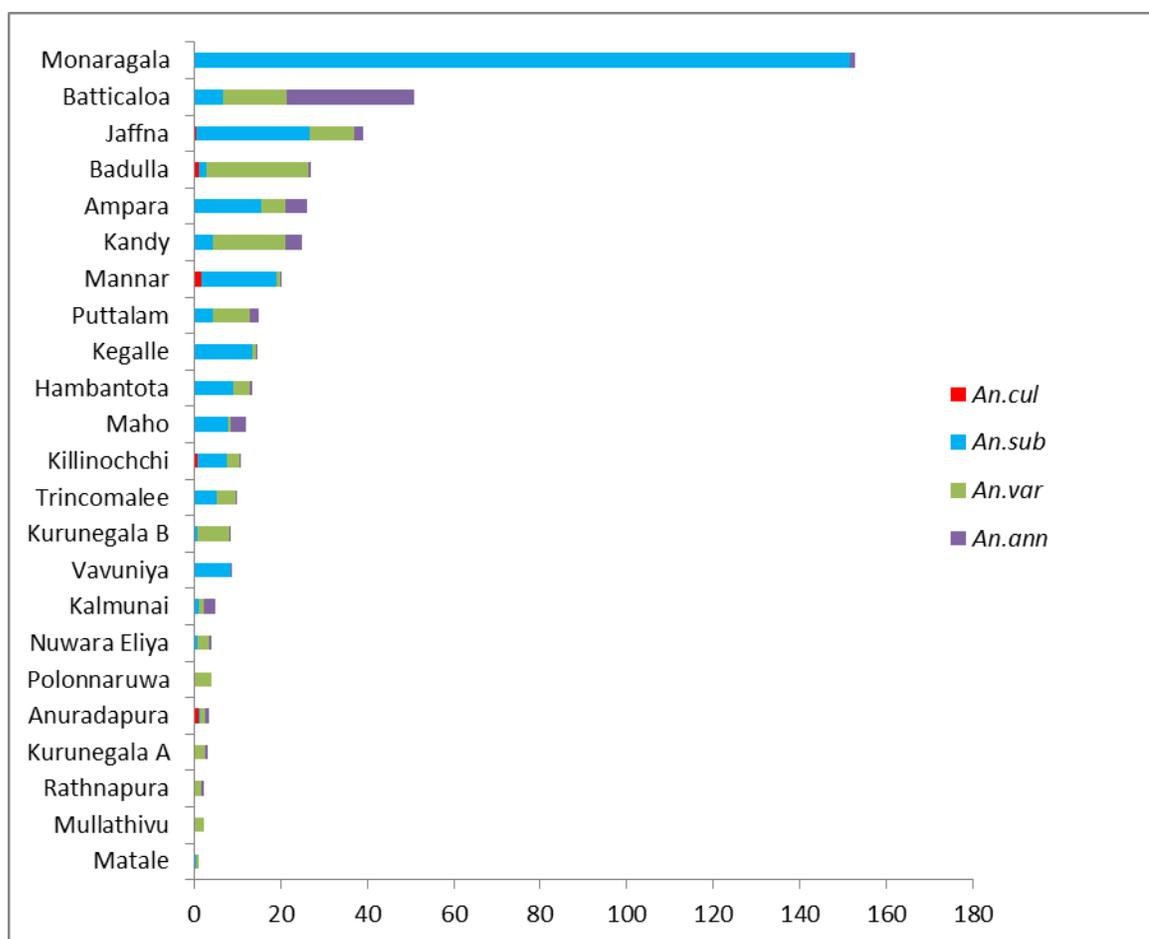


Figure 9: Mean density of malaria vector females caught in cattle baited trap collections in different districts during 2015

Indoor Hand Collections 2015

Hand collection of indoor resting *Anopheles* mosquitoes was performed in many of the RMO regions. This technique provides useful information such as seasonality of indoor resting of vectors and their resting sites inside human dwellings.

Figure 15 shows the indoor resting densities of *Anopheles culcificacies* and *Anopheles subpictus* in RMO Regions where the indoor hand collections had been carried out. In the twenty RMO regions where indoor hand collections were carried out it was observed that indoor resting *Anopheles subpictus* densities were higher than *Anopheles culcificacies* indoor resting densities. Highest density of *Anopheles subpictus* was recorded from Mullaitivu district followed by Anuradapura and Jaffna. *Anopheles culcificacies* highest density was recorded from Maho RMO region of Kurunegala district.

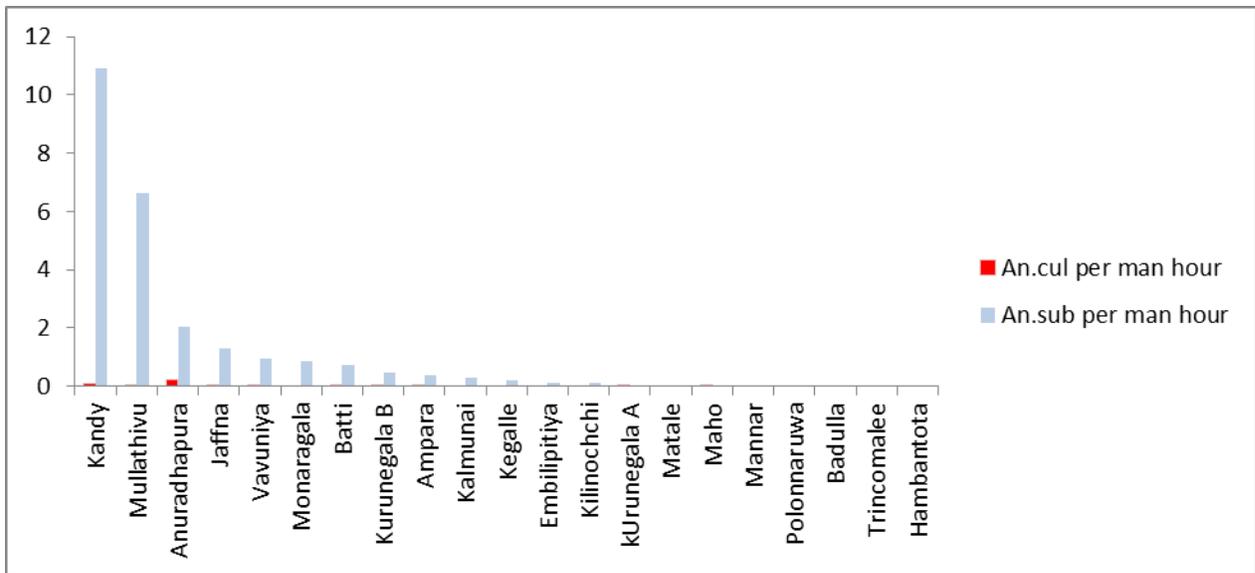


Figure 10: Indoor resting densities of *Anopheles culcificacies* and *Anopheles subpictus* in RMO Regions

Human landing catches

Human landing catches serves as a good indicator of assessing the risk of malaria transmission in the malaria elimination phase as there is no indigenous transmission Results of partial night (6.00 p.m.to 9.00 p.m.) human landing catches in 22 RMO regions are as follows.

Biting Preferences of Malaria Vectors

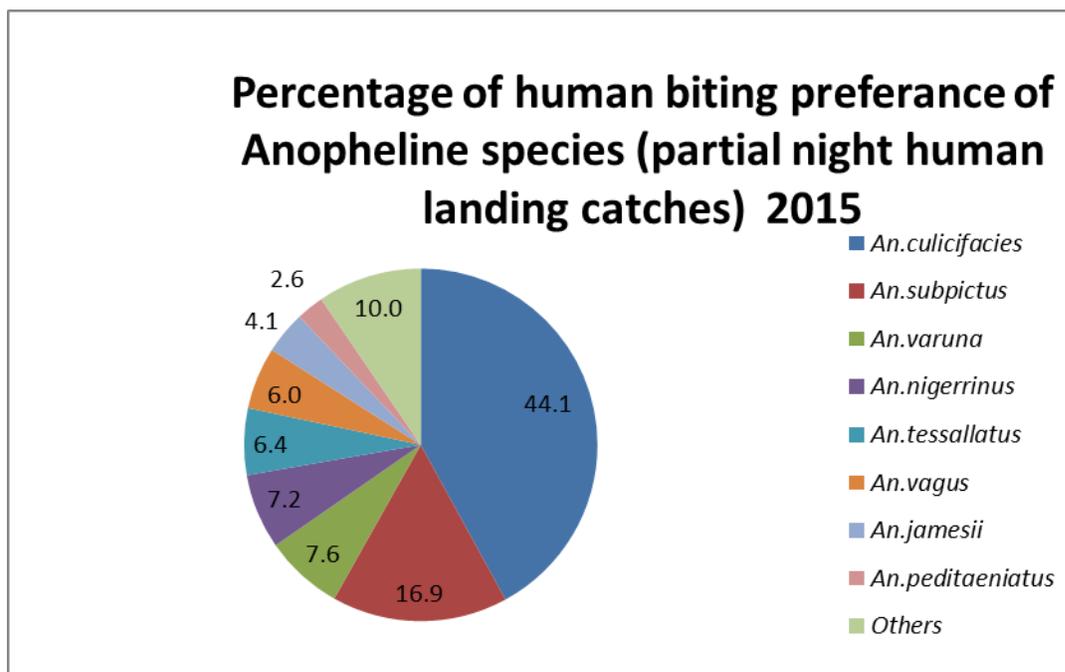


Figure 11: Percentage of human biting preferences of *Anopheles* species caught during partial night human landing catches

Despite the malaria eliminated situation in the country the human landing catches were continued to assess the risk of malaria transmission. *Anopheles culicifacies* Major the malaria vector was found more abundantly than all the other human biting *Anopheles* species (44.1%), followed by *Anopheles subpictus* (16.9%), *Anopheles varuna* (7.6%) and *Anopheles nigerrimus* (7.2%). The other noticeable human biting species were *Anopheles tessellatus*, *Anopheles vagus*, *Anopheles jamesii* and *Anopheles peditaeniatus*.

Biting rates of malaria vectors

The same biting pattern of *An. culicifacies* observed in the previous years was observed in 2015, indicating that outdoor biting is higher than indoor biting. Figure 12 depicts the monthly trends of *Anopheles culicifacies* human biting rates in 18 RMO regions.

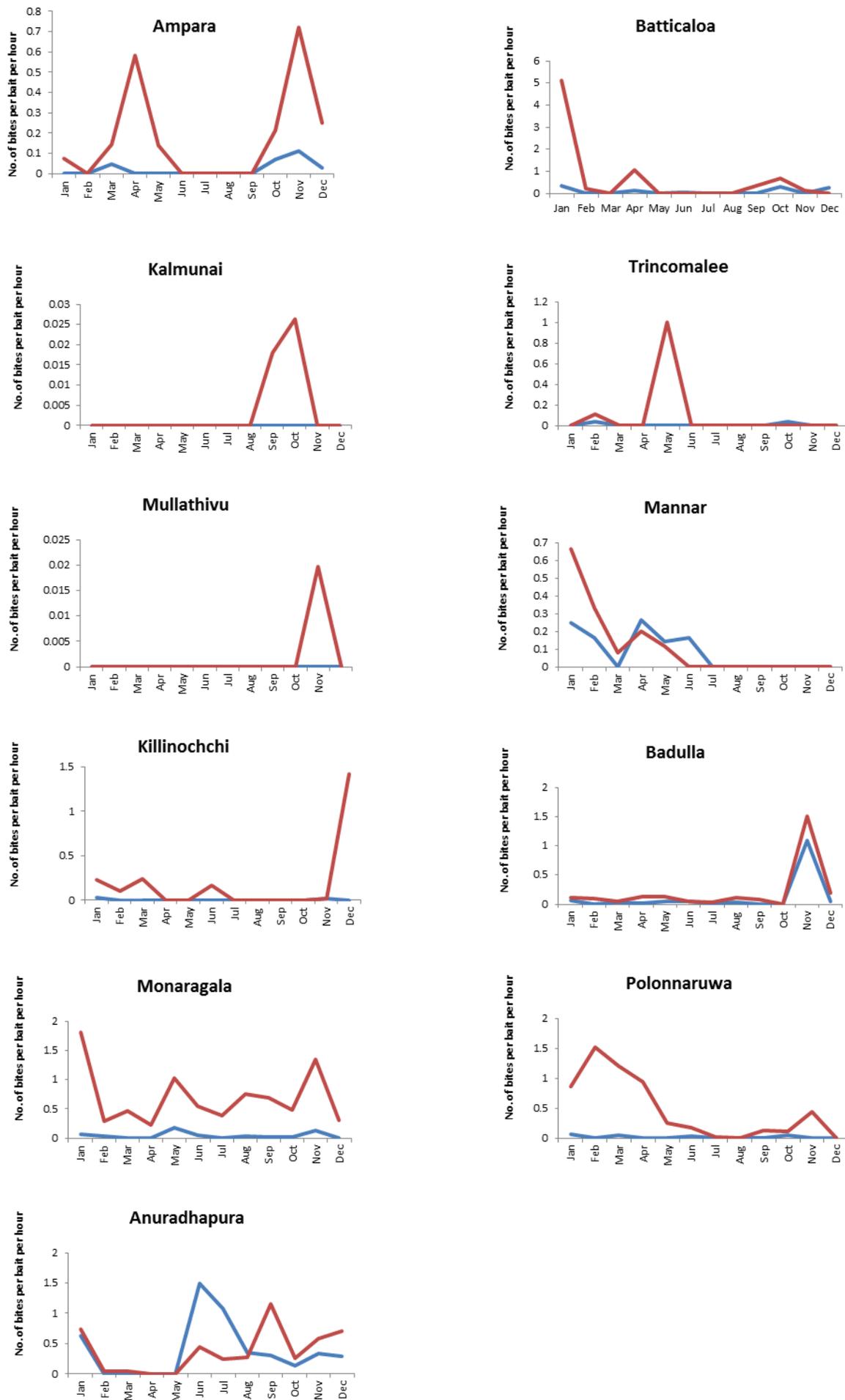
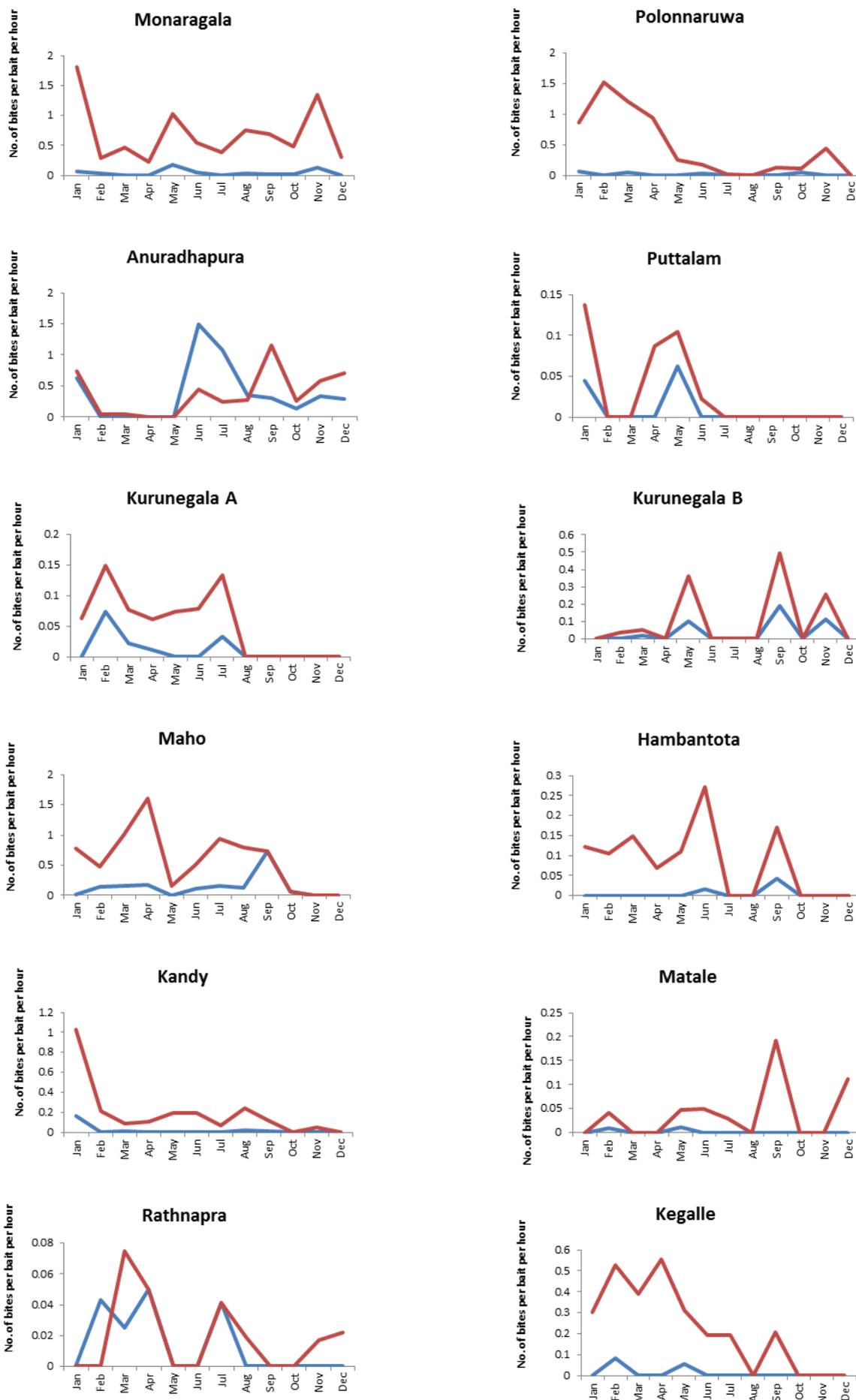


Figure 12 : Monthly trends of *Anopheles culicifacies* human biting rates in 18 RMO regions

Figure 12 :Monthly trends of *Anopheles culicifacies* human biting rates in 18 RMO regions...



Insecticide Resistance Monitoring

In 2015 susceptibility status of eleven *Anopheles* species was tested using standard WHO insecticide susceptibility kits for discriminative dosages of eleven insecticides. Table. shows insecticide resistance status of *An. culicifacies* in different MOH areas. The susceptibility tests performed for more than fifty mosquitoes for tests are summarized and high resistance for Malathion 5% was observed in *An. culicifacies* in Medagama MOH area of Moneragala District and shown in Table 6.

Class	Insecticide & Concentration	Resistance status in different MOH areas		
		Susceptible	Moderate	High
OP	Malathion 5%	NR	NR	Medagama
PY	Bifenthrin 0.2%	Sevanagala	NR	NR
PY	Etofenprox 0.5%	Rikillagaskada	NR	NR
PY	Lambdacyhalothrin 0.05%	Rikillagaskada	NR	NR

NR- No records

Table 6 Susceptibility status of *An. culicifacies* to different insecticides

Table 7 shows insecticide resistance status of *An. subpictus* in different MOH areas. *An. subpictus* has reported high resistance to four types of pyrethroid insecticides.

Class	Insecticide & Concentration	Resistance status in different MOH areas		
		Susceptible	Moderate	High
PY	Bifenthrin 0.2%	Paddipalai	NR	Wariyapola
PY	Cyfluthrin 0.15%	NR	NR	Addalachchenai Thissamaharama
PY	Deltamethrin 0.05%	Pointpedro Chankanai Nikaweratiya Paddipalai		
PY	Lambdacyhalothrin 0.05%	Addalachchenai Paddipalai Vavunathivu		
OP	Malathion 5%	Chankanai		Thissamaharama
C	Propoxur 0.1%			Lunugamvehera

NR- No records

Table 7. Susceptibility status of *Anopheles subpictus* to different insecticides

Vector Control Activities

Integrated vector management is the main strategy of malaria vector control in Sri Lanka. Integral components of this strategy are the rational use of insecticides in rotation for Indoor Residual Spraying (IRS), distributing Long Lasting Insecticide treated Nets (LLINs), breeding and introduction of larvivorous fish, environmental modulation and modification through the filling of abandoned gem pits and space spraying for special occasions. Table 8 shows that Lambda cyhalothrin is the only insecticides that had been used for indoor residual spraying in different districts.

District	Deltamethrin	Cyfluthrin	Etofenprox	Lambda-cyhalothrin	Bifenthrin
Kandy				×	
Matale				×	
Vavuniya				×	
Mannar				×	
Mullativu				×	
Batticaloa				×	
Ampara				×	
Maho				×	
Puttalam				×	
Anuradhapura				×	
Moneragala				×	
Badulla				×	
Kegalle				×	

Table 8: Insecticides usage in different districts for indoor residual spraying during 2015

During the year 2015, the total number of houses fully sprayed was 14,690, partially sprayed was 494 and the total population covered was 51831. Only Lamda-cyclothrin 10% wdp was used during 2015 for malaria related spraying.

Lavivorous fish were introduced in to wells and abandoned gem-pits as a biological method of vector control.

Table 9 shows the districtwise distribution of Long Lasting Insecticide treated Nets (LLINs) during 2015.

District/ Institution	No. of LLINs distributed
Kandy	1336
Matale	431
Kilinochchi	416
Vavuniya	47
Mannar	4303
Mullativu	5882
Batticaloa	2671
Ampara	6004
Trincomalie	380
Kurunegala	706
Maho	739
Puttalam	764
Anuradhapura	483
Polonnaruwa	509
Moneragala	1187
Badulla	644
Ratnapura	1265
Kegalle	27
Total	27794

Table 9: Distribution of Long Lasting Insecticides Treated Nets (LLIN) for Malaria Control during 2015

Infrastructure and Human Resources

At the end of year 2015, AMC Headquarters had following category of staff. The below Table 10 shows the number of staff in each category as at the end of year 2015.

Category Name	Approved cadre	In position
Director	1	1
Deputy Director	1	1
Medical Consultant	3	3
Medical Officer	5	4
Accountant	1	1
Entomologist	4	2
Parasitologist	1	1
RMO / AMC	1	1
Special Grade Entomological Assistant	1	0
Special Grade PHLT	2	0
Entomological Assistant	6	7
Medical Laboratory Technologist	3	0
Public Health Inspector	2	2
Public Health Laboratory Technician	22	9
Information and Communication Technology Assistant	2	1
Health Education Officer	1	0
Information and Communication Technology Officer	1	0
Development Assistant	4	4
Medical Records Assistant	1	0
Planning and Programme Assistant	1	0
Public Health Field Officer	10	4
Public Management Assistant	17	8
Medical Supplies Assistant	3	0
Telephone Operator	0	2
Cinema Operator	1	1
Health Driver	19	9
Lab Orderly	3	2
KKS	1	1
Lift Operator	2	2
Saukyaya Karyaya Sahakara (Junior)		12
Saukyaya Karyaya Sahakara (Junior) – Anuradhapura	20	20
Saukyaya Karyaya Sahakara (Ordinary)	25	3
Spray Machine Operator	19	7
Ward Clerk	0	1
Development officer	5	5
Casual Saukyaya Karyaya Sahakara (Junior)	0	6
Total	188	120

Table 10: Staff position at Anti Malaria Campaign Headquarters during 2015

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. In 2015 AMC Headquarters had the following number of vehicles.

Type	Reg. No.	Road Worthy	Available at HQ
Mitsubishi Fuso Lorry	42-1607	Yes	Yes
Mitsubishi Fuso Lorry	42-9399	Yes	Yes
Mitsubishi Fuso Lorry	LC-0249	Yes	Yes
Mitsubishi Pajero jeep	32-6520	Yes	Yes
Mitsubishi L300	GP-2558	Yes	Yes
Mitsubishi L300	GP-2556	Yes	Yes
Mitsubishi Double-cab	JL 8129	Yes	Yes
Mitsubishi Double-cab	PE-8966	Yes	Yes
Mitsubishi Double-cab	PE-8972	Yes	Yes
Mitsubishi Double-cab	PE-8974	Yes	Yes
Mitsubishi Double-cab	PE-8975	Yes	Yes
Mitsubishi Double-cab	PF-2025	Yes	Yes
Toyota D/Cab	GQ-2646	Yes	Yes
Nissan Caravan	NA-3117	Yes	Yes
Nissan Van	NB-4567	Yes	Yes
Nissan Van	NB-4568	Yes	Yes
Micro D/Cab	PB 6537	Yes	Yes

Table 11: Vehicles available at Anti Malaria Campaign Headquarters

Drugs

A buffer stock of antimalarial drugs to face any emergency is available in the Headquarters. The following table shows the distribution of drugs for districts in the year of 2015.

Recipient	Chloroquine tablets	Primaquine tablets	Quinine tablets	Quinine injection
Ampara	3000	590	-	60
Anuradhapura		750		60
Badulla	160		50	100
Colombo		750	20	50
Embilipitiya		300		
Hambantota	100	800	40	20
Kalmune		252	10	20
Kandy	1500	750	50	55
Kegalle	2000	250		
Kilinochchi	250	250		
Kurunegala		600	20	10
Maho	1000			5
Mannar				
Matale	2000		100	15
Moneragala	2000			50
Mullativu	1000	100		
Puttalam	500			5
Trincomalie	500	250	35	20
Vavuniya	1000	500		20
Batticaloa				
Jaffna	2000		105	30
Polonnaruwa			20	40
AMC HQ	2090	1606	215	180
Total	19100	7748	665	740

Table 12: Distribution of drugs for districts in the year of 2015

Buildings

The Anti Malaria Campaign Headquarters is located at the Public Health Complex at 555/5, Elvitigala Mawatha, Colombo 5. The Director's room, Deputy Director's room, Project Director's room of GFATM, Community Physicians' room, Medical Officers' room, GFATM project office, library, computer room, telephone exchange and auditorium are in the 3rd floor. The Administration branch, finance branch, record room and stores are located in the 5th floor. The Central Parasitology Laboratory and Entomology Laboratory are located in the 6th floor.

Foreign Funded Projects

During the year 2014, GFATM and WHO assisted malaria elimination activities in Sri Lanka.

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

During the year 2014, National Malaria Elimination Programme continued to receive support from the GFATM in the form of one grant for malaria elimination under the Round 8.

GFATM Round 8 Malaria Elimination Project

This project aims at scaling up efforts of the National Malaria Control Programme and focus on elimination of *P. falciparum* malaria by end of 2012 and elimination of *P vivax* malaria by end of 2014. Round 8 GFATM Project covers all the districts in the country.

The following activities were carried out during the year 2014 under this project.

Conducting malaria mobile clinics

Two thousand six hundred and sixteen malaria mobile clinics were conducted to reduce malaria transmission among vulnerable and mobile populations through early detection and treatment. A total of 187,582 blood smears examined from all project districts and no positive cases detected.

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 35,000 Rapid Diagnostic Test kits were purchased and distributed to districts for enhancing 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

Ten additional days per month 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.

Strengthening of entomological and 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.

Malaria field staff (PHII, PHFOO, PHLTs, PHFO & SMOO) were trained on malaria elimination activities.

Monthly review meetings were carried with the participation of Regional Malaria Officers, Technical Staff of AMC Headquarters and representatives from Sarvodaya and TEDHA, at Anti Malaria Campaign Headquarters assess to the progress of malaria elimination activities qualitatively and quantitatively.