



Annual Report 2016



Anti Malaria Campaign
Ministry of Health
Sri Lanka

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Foreword

The Anti Malaria Campaign of the Ministry of Health, Nutrition and Indigenous Medicine, Sri Lanka is presenting the Annual Report on Malaria Elimination and Prevention of Re-introduction Programme for the year 2016. The Programme is responsible for the prevention of resurgence of malaria and to ensure malaria free Sri Lanka. Anti Malaria Campaign (AMC) is having public health service network through regional malaria offices and linkages with curative health sector for the treatment services.

It is the year that Sri Lanka obtained WHO certification as a malaria free country on 5th September. It is a remarkable public health achievement in the history of Sri Lanka. At this juncture, continuing the vigilant case surveillance for imported cases and vigilant vector surveillance become the two major strategies of the campaign. Rapid Response Team is responsible to take immediate investigations when a suspected malaria case is reported. Routine entomological and parasitological surveys are done by the parasitological and entomological teams. It is mandatory notification all the suspected malaria cases to Anti Malaria Campaign. AMC confirms the diagnosis by malaria laboratory investigations (microscopy/Rapid Diagnostic Test/PCR). Medicines for treatment of malaria are provided by the AMC. Each confirmed case of malaria is reviewed by an independent expert case review committee of the Technical Support Group with regard to case management and classification.

The report will facilitate programme managers to review, revise and monitor the policies and strategic plans to sustain the malaria free status of the country.

Dr H D B Herath

Director

Anti Malaria Campaign

Acknowledgements

The annual report provides the progress of National Malaria Elimination and Prevention of Re-introduction Programme for the year 2016. 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. Consultant community physicians, medical officers, parasitologist, entomologists, staff from entomological and parasitological units, staff from the administration and finance units and staff from the regional malaria offices need to be thankfully remembered for their inputs. The public health staff from all over the country who have made immense efforts to achieve malaria free status should be highly appreciated. Staff of the information management unit and the monitoring and evaluation unit to be appreciated for the effort they have taken to make the data management.

AMC is extremely in depth for the Technical as well as the financial supports offered by the development partners; World Health Organization and Global Funds for Fight against AIDS, Tuberculosis and Malaria (GFATM), during the year 2016.

Introduction

Sri Lanka entered in to the phase of prevention of re-introduction from elimination of malaria. The last indigenous case was reported in October 2012. Since then all cases reported were transmitted in abroad. After maintaining the zero indigenous transmission for 3 consecutive years, followed by thorough evaluation by World Health Organization (WHO) team, Sri Lanka got certification as “malaria free country” on 5th September 2016. Anti-Malaria Campaign has been able to retain zero indigenous transmission of malaria for the 4th consecutive year by 2016.

Being a tropical country, the favorable environment for breeding of vectors makes continuous receptivity in most parts of the country. Currently, the biggest threat to the elimination efforts is the risk of resurgence due to imported malaria case. Over the past six years, the imported malaria cases were being reported from foreign travelers and Sri Lankan nationals who were returning from malaria endemic countries. With enhanced parasitological surveillance, 41 imported malaria cases were reported in 2016 compared to 36 in 2015.

The activities of Anti Malaria Campaign are carried out 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 reintroduction 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 reintroduced 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.

Prevention of re-introduction and preparedness for control of epidemics/outbreaks

There was no local transmission of malaria since November 2012. The following strategies are in use to prevent re-introduction and control outbreaks

- Vigilant case surveillance and notification system
- High risk group surveillance system
- Entomological surveillance (sentinel site surveys ,random spot surveys and case based surveys)
- Monitoring of insecticide susceptibility
- Pharmacological vigilance for anti malaria medicines
- Rapid Response team for each region to act quickly when a malaria case is reported

Monthly Progressive Review Meetings

Monthly Progressive Review Meeting which was started in 2009 and continued with the participation of Regional Malaria Officers, Stake Holders as Tri Forces Sri Lanka, Sri Lanka Police, members of the Non-Government organizations and the Technical officers of Anti Malaria Campaign. This has been conducted once a month to review the progress of the regional and central level activities which were carried out in the previous month. The operational decisions were taken towards the achievement and maintaining of the status of malaria free country. During these review meetings the RMOO report on the work that is being conducted in the regions. According to the reports AMC/HQ is able to develop appropriate response by way of strategies and policies. During the meetings the following are addressed.

- Parasitological Surveillance- Conducting malaria mobile clinics and screening for malaria positive blood smears are two of the high priority indicators required by donor agent (GF). The cases of malaria reported and identified are to be followed up and reviewed. The areas and sites related to malaria cases and are receptive on account of mosquito vector prevalence are to be examined. Then an assessment of the situation is made with the participation of parties involved eg. Technical staff of the AMC, members of the Tri forces etc.
- Entomological Surveillance- In addition to that the entomological surveillance activities and control activities that are conducted are also reviewed. If the RMOs are in need of

any technical guidance, it is provided. In the event that technical support is provided by way of indoor residual spraying or larviciding by the technical officers of the AMC, then the out come of such remedies are assessed. Further, technical assistance may be provided for breeding of fish, distribution of LLINs etc.

- Patient management- The discussions on patient management extended to the issues of notification of suspected cases, diagnosis and establishment of malaria in suspected persons, providing instructions and ensuring the availability of medicines, conducting clinicians programmes and awareness programmes for RMOOs and other medical staff to raise their knowledge in malaria are reviewed and discussed.
- In order to prepare RMOO and other medical staff for an eventual indigenous cases or an outbreak in the country, it is necessary to ensure staff competencies and in addition, RMOOs and other nursing staff are given advice and training on management of patients in line with the National Treatment Guidelines.
- The RMOOs and other medical staff who report to AMC, seek guidance and advice on various policy and operational issues when required, AMC headquarters assist them whenever possible to find solution to these financial, administrative as well as technical issues with the consultation of Ministry of Health and its regional Directors.

Technical Support Group

The Director General of Health Services has appointed a Technical Support Group (TSG), for the purpose of providing carefully considered evidence based strategic and technical advice and recommendations to the Anti Malaria Campaign (AMC) for the prevention of reintroduction (PoR) of malaria to Sri Lanka. The TSG comprises 17 members with a broad range of expertise in fields relevant to malaria control and elimination, which include parasitology, malariology epidemiology, pharmacology, general medicine, vector control and biology, sociology and disease control. Members do not represent institutions or organisations but functions in their individual capacities to provide expertise and guidance to the AMC. The TSG also includes members from the Ministry of Health at the central and provincial levels including the AMC.

In order to be able to respond to specific challenges as they arise, additional members with expertise in particular fields may be invited to attend the TSG meetings as temporary advisers

or as co-opted members. The TSG will be chaired by the Director General of Health Services. The TSG functions in a purely advisory capacity to provide advice and recommendations to the DGHS and Director AMC. The Ministry of Health supports and provides facilities and resources to conduct meetings and relevant activities of the TSG. The membership of the TSG will be reviewed every 3 years and revised according to needs.

TSG is convened once every two months on a pre-determined date, agreeable to a majority of the members. Additional meetings may be called if and when necessary. During the courses of the year TSG members supported and technically guided the AMC in its successful transition to the Prevention of Re-introduction phase.

Some TSG members also constitute a Case Review Committee which meets every month to conduct an independent review of every case of malaria reported in the country.

Programme priorities

Vigilant case surveillance, high risk group screening and vector surveillance were the priority interventions during 2016. Malaria prevention among security forces visiting African countries and Haiti, Sri Lankan returnees from India, refugees and asylum seekers were considered as risk groups and attended accordingly. Awareness programmes to enhance the capacities of clinicians in government and private hospitals on early diagnosis and treatment was identified as a priority during the year 2016.

In the early part of the year 2016, the most resources of AMC was dedicated for preparing the whole country for the WHO certification process. The National coordinator for “WHO malaria free certification process” was appointed by the Ministry of Health to facilitate the preparation of the health system for the certification process and which was ended successfully making a land mark victory in century old history of malaria control in Sri Lanka on the 5th of September 2016, where Sri Lanka was certified as a “Malaria free” country.

Information management

Network facilities were 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.

All malaria cases and potential vector breeding sites were mapped with the using GIS.

To enhance the case surveillance & response in the private sector hospitals, a communication cell Headquarters was maintained at the AMC.

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

Epidemiology

Sri Lanka has succeeded its vision to be a malaria free country and obtained the WHO certification on 5th September 2016. There were no indigenous malaria cases since October 2012, but imported cases were being reported each year. The majority of imported malaria cases were Sri Lankan nationals returning from malaria endemic countries. In 2016, out of 41 imported cases reported, 28 (68.3 %) were Sri Lankans.

A total number of 1072396 blood smears were examined during 2016 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 2015 and 2016.

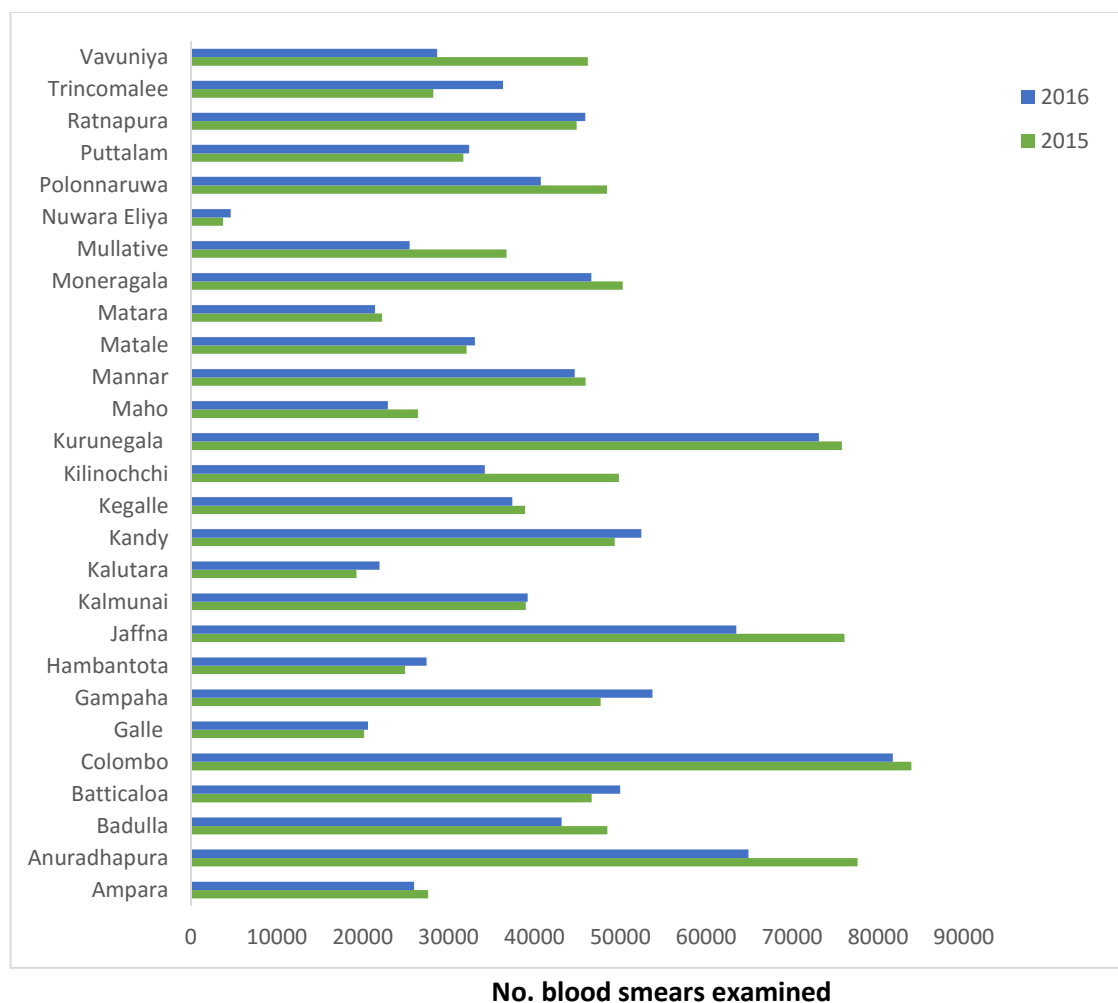


Figure 1: Number of blood smears examined during the years 2015 and 2016, by districts

Following the screening, no indigenous malaria cases were reported, although 41 imported malaria cases were detected. This included 16 cases of *P. vivax* infections, 18 cases of *P. falciparum* infections, 5 cases of *P. ovalae*, one case of *P. malariae* and one case of *P. knowlesi* infection. *P. knowlesi* is the 5th plasmodium species which causes malaria in monkeys. It was reported in an armed personnel who had military training in Malaysia.

Table 1 shows the proportion of malaria species detected during the last 10 years (2007-2016).

Year	Total cases	<i>P. vivax</i>			<i>P. falciparum</i>		Mixed		Other	
		No	No	%	No	%	No	%	No	%
2007	198	191	96.4	6	3.0	1	0.6			
2008	670	623	93.0	29	4.3	17	2.5	1(Pm)	0.1	
2009	558	529	95.0	21	3.8	8	1.2			
2010	736	704	95.3	17	2.3	14	2.2	1(Pm)	0.1	
2011	175	158	90.3	12	6.8	5	2.6			
2012	93	45	48.3	42	45.2	4	4.3	2(Po)	2.2	
2013	95	52	54.7	42	44.2			1(Po)	1.0	
2014	49	28	57.1	20	40.8			1(Pm)	2.0	
2015	36	17	47.2	17	47.2			2(Po)	5.5	
2016	41	16	39.0	18	43.9			5(Po),1(Pm) &1(Pk)	17.0	

*Pf-*P. falciparum*, Pv *P. vivax*, Po *P. ovalae*, Pm -*P. malariae* and Pk - *P. knowlesi*

Table 1: Proportion of malaria cases during the last 10 years (2007-2016) by species

The number of imported malaria cases detected during this year was slightly more than that for 2015 - from 36 cases in 2015 to 41 cases in 2016.

Figure 2 shows the district wise comparison between the numbers of imported cases reported in the country during year 2014 to 2016. Majority of cases were reported from Western Province (Colombo, Gampaha and Kalutara districts).

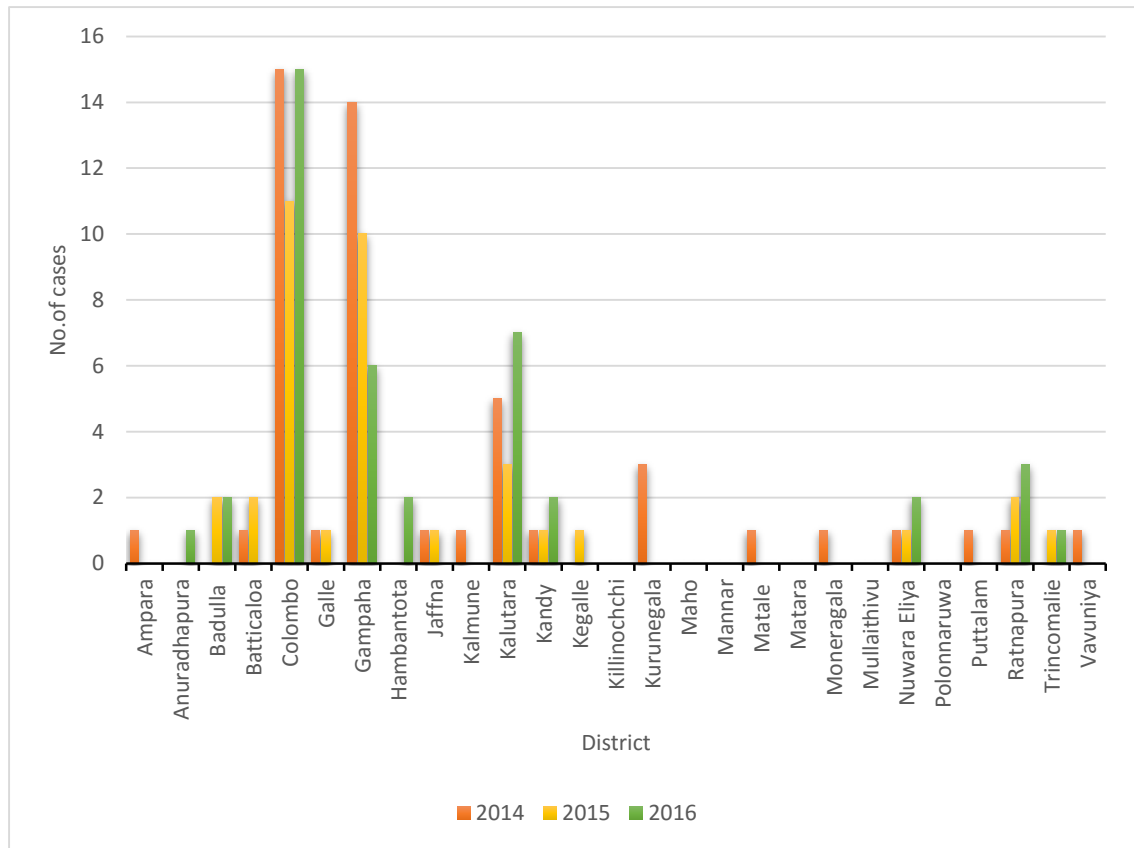


Figure 2: Distribution of imported malaria cases reported during 2014-2016 by districts

Table 2 shows the type of infection by the country of origin. Majority of cases (56%) were imported from African region (Figure 3).

	Species					Total
	<i>Pf</i>	<i>Pv</i>	<i>Po</i>	<i>Pm</i>	<i>P.k</i>	
Central Africa	1		1	1		3
China			1			2
Congo	1		1			1
India		14				14
Kenya	1					1
Liberia			1			1
Madagascar	1					1
Malawi	1					1
Malaysia					1	1
Mozambique	6					6
Indonesia		1				1
Solomon Islands		1				1
Sudan	1					1
Tanzania	1					1
Uganda	5		1			6
Total	18	16	5	1	1	41

Table 2: Distribution of imported cases reported during 2016 by type and country of origin

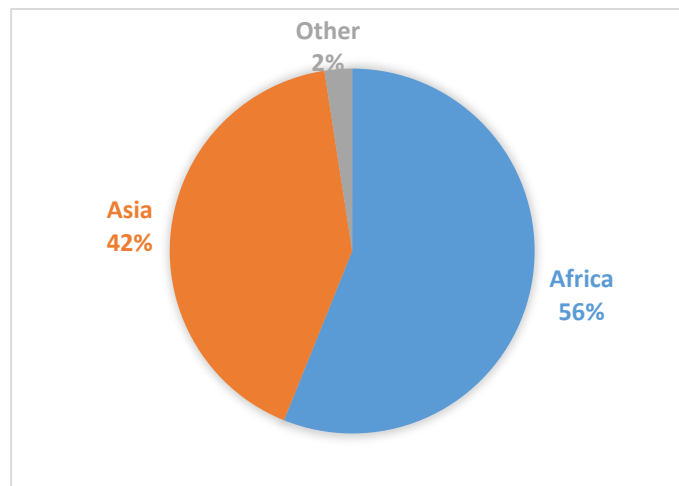


Figure 3 : Proportion of Imported malaria cases during the year 2016, by region of origin

Majority of malaria cases (68.3%) were Sri Lankan males (92.7%) between the age of 26-45 (46.3%) (Table 3) and the purpose of travel was mainly for occupation and business (Table 4)

Age Group	Male (No. %)	Female (No. %)	Total (No. %)
<15	0(0.0)	0(0.0)	0(0.0)
15-25	5(12.2)	0(0.0)	5(12.2)
26-35	19(46.3)	0(0.0)	19(46.3)
36-45	6(14.6)	0(0.0)	6(14.6)
46-55	4(9.8)	2(4.9)	6(14.6)
56-65	3(7.3)	1(2.4)	4(9.8)
>65	1(2.4)	0(0.0)	1(2.4)
	38(92.7)	3(7.3)	41(100)

Table 3 : Age-Sex distribution of reported malaria patients in 2016

Nationality	Purpose of travel				Total
	Occupation	Business	Forces	Tourist/ Pilgrims	
Sri Lankan	11	9	6	2	28
Australian				2	2
Chinese	2				2
Indian	7				7
Indonesian				1	1
Israel				1	1
Total	20	9	6	6	41

Table 4: Distribution malaria cases during 2016, by nationality and purpose of travel

Chemoprophylaxis

The Anti Malaria Campaign provided chemoprophylaxis for the travelers to malaria endemic countries based on National guideline. AMC headquarters has provided chemoprophylaxis for 1939 persons during the year 2016. Mefloquine (18481 tablets) Chloroquine (1273 tablets) and Doxycycline (570 tablets) were issued to them depending on the country they visited. Majority of these travelers were males and above 18 years old.

Mortality

No deaths due to malaria were reported since the year 2008.

Status of drug resistance and drug policy

Anti Malaria Campaign has taken every possible measure to use quality assured WHO prequalified anti malarial drugs. All the *P. falciparum* and *P. vivax* positive patients were followed-up to detect resistant strains of the parasite to artemisin therapy and chloroquine respectively. There were no events that suggestive of therapeutic failures observed among treated *malaria* cases during 2016.

Parasitological Surveillance

The parasitological surveillance in the country is implemented mainly through screening of individuals attending to medical institutions and field level screening done in vulnerable localities. Screening done at medical institutions is categorized as Passive Case Detection (PCD) which included medical institutions without 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 2016, a total of 1,072,396 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 4.

District/ RMO Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Ampara	2015	2487	2962	2109	2202	2155	2161	2224	2213	1850	2239	1380	25997
Anuradhapura	6651	6081	5642	4853	5550	5655	4993	5010	5057	4850	5267	5310	64919
Badulla	3797	4144	3533	3178	4346	4176	3567	4073	3899	2058	3426	2951	43148
Batticaloa	3477	3063	3531	2988	2640	5330	4738	4947	4294	5180	4644	5164	49996
Colombo	7314	6193	5748	6113	7548	7097	7032	6679	7527	6686	7109	6674	81720
Embilipitiya	4221	4407	3489	3593	3545	3716	4099	3490	3633	4319	3922	3503	45937
Galle	1537	1539	1466	1638	1639	1871	1490	1972	1748	2023	1709	1976	20608
Gampaha	4339	5280	5671	3032	4838	3552	4703	3945	4206	3374	6656	4155	53751
Hambantota	2013	2079	1883	1616	2376	2557	3937	2181	2206	2097	2208	2270	27423
Jaffna	6008	5519	5761	4873	5849	5390	5386	5406	4228	4169	4480	6443	63512
Kalmune	3273	4145	3565	3312	2988	3220	2271	3465	3445	3645	3642	2235	39206
Kalutara	1303	1544	1953	1403	1498	1339	2522	2100	2090	2128	1667	2409	21956
Kandy	4773	4779	4279	3888	4107	3680	3827	4045	4623	5429	5014	3989	52433
Kegalle	3392	3881	3879	2419	3246	2651	2796	3726	2556	2911	2752	3229	37438
Kilinochchi	3026	3437	3920	2535	2548	3469	3288	2840	2040	2469	2152	2494	34218
Kurunegala	6213	6309	6115	5124	6462	6254	5142	5493	7197	6115	6427	6280	73131
Maho	2764	2464	2462	1794	2168	2097	1648	1684	1282	1574	1609	1370	22916
Mannar	4241	4761	3854	3373	4563	3638	3495	3623	3597	2966	3353	3234	44698
Matale	2927	2673	2844	2202	2673	2901	3177	3271	2528	2248	2765	2849	33058
Matara	1831	2156	1472	1699	1663	1196	1722	1701	1805	1967	2226	2002	21440
Moneragala	4483	3844	4270	3234	3795	3574	4937	3587	3580	3898	3691	3733	46626
Mullaitivu	2106	2125	2362	1529	1634	2057	1933	2353	2084	2379	2555	2363	25480
Nuwaraeliya	398	223	303	404	285	269	332	216	201	389	784	844	4648
Polonnaruwa	3289	3425	3632	2940	3580	4378	3456	4350	21	4037	4316	3313	40737
Puttalam	2267	3191	3390	2387	2608	2885	2614	2379	2324	3126	2906	2307	32384
Trincomalee	2991	3006	2808	2263	2595	3081	2787	3698	3268	3234	3457	3143	36331
Vavuniya	3883	1627	1816	1245	1943	1808	2223	2639	2204	2613	3470	3214	28685
Total	94532	94382	92610	75744	88889	89996	90276	91097	83856	87734	94446	88834	1072396

Table 5 : Total number of blood smears examined during the year 2016 by districts

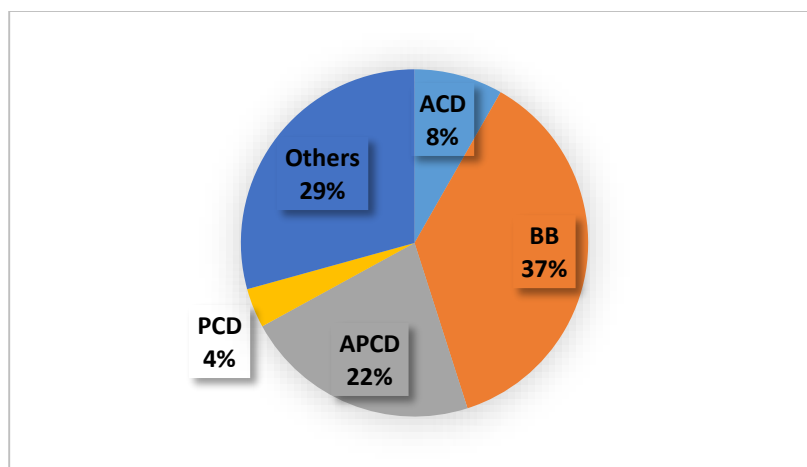


Figure 4: Total number of blood smears screened during the year 2016 by source

Provision of laboratory items

The Central laboratory, Anti Malaria Campaign Head Quartos (AMC HQ) distributed laboratory items required for malaria microscopy to regional malaria laboratories to ensure quality assured and quality controlled malaria microscopy services throughout the country. Some laboratory items issued during the year 2016 are given in Table 6.

District/RMO region	Glass Slides	Lancets	Methanol (L)	Giemsa (L)	RDT Kits	Anisol (L)
Ampara	22500	20000	3.5	1	750	1
Anuradhapura	27500	30000	5	3.5	1000	2.5
Badulla	14500	15600	5	2.5	1000	3.5
Batticaloa	30000	36000	10	7	1125	0.75
Hambantota	35000	20000	2.5	3.5	1250	-
Jaffna	20750	39000	2.5	7.5	2800	-
Kalmune	20000	20000	1.5	1	1000	-
Kandy	-	-	-	-	1125	-
Kegalle	10000	10000	5	3	325	-
Kilinochchi	5000	33000	-	-	500	-
Kurunegala	2500	-	7.5	-	500	-
Maho	-	-	-	-	500	-
Mannar	26250	15000	2.5	-	1475	-
Matale	22500	11000	5	-	600	-
Monaragala	22500	35000	-	2	800	-
Mulativu	6500	6000	6.5	3.6	1250	2
Polonnaruwa	7500	-	3.5	0.7	1200	1.5
Puttalam	5000	-	2.5	2.5	1200	1
Trincomalee	15000	18000	2.5	3	2375	-
Vavuniya	5750	5000	2.5	-	500	-
Total	298750	313600	67.5	40.8	21275	12.25

Table 6 : Laboratory items issued during the year 2016

Activities related to quality assurance of malaria microscopy

With the aim of improving quality of malaria microscopy services in the country, 17 two day in-service training programs were conducted for Public Health Laboratory Technicians and Medical Laboratory Technologists. For private sector Laboratory Technicians, eight (8) one day training programs were conducted. Training was provided on the proper preparation and collection of blood smears and microscopical diagnosis of malaria. In addition, instructions were given to the Public Health Laboratory Technicians on preparatory activities related to the WHO certification process. The Standard Operating Procedures for malaria microscopy were also printed and distributed.

With the aim of improving the work performance of the Central reference and regional QA/QC laboratories, another group of 26 PHLTT were trained on quality assurance and quality of malaria microscopy with the assistance of ACTMalaria. Details of the PHLTT trained are given in table 7.

Province	RMO Region/District	Number of PHLTT trained on QA/QC of malaria microscopy with the assistance of ACTMalaria
NCP	Anuradhapura	1 PHLT trained
	Polonnaruwa	1 PHLT trained
NWP	Kurunegala	2 PHLTT trained
	Maho	1 PHLT trained
	Puttalam	1 PHLT trained
CP	Kandy	1 PHLT trained
	Matale	1 PHLT trained
	Nuwara Eliya	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	Batticaloa	1 PHLT trained
	Ampara	1 PHLT trained
	Kalmune	1 PHLT trained
WP	Gampaha	2 PHLT trained
	Colombo	6 PHLT trained (5 from AMC HQ)
	Kalutara	1 PHLT trained

Table 7 : Districts/RMO regions from where PHLTT were selected for the QA/QC training in 2016

Special parasitological surveillance activities carried out by the Anti Malaria Campaign

During the year 2016, 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.

Entomological 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 2016. The routine entomological monitoring at the sentinel sites was continued, whereas random spot checks were conducted in other receptive and vulnerable areas and case based (Reactive) entomological investigations were carried out in areas where imported malaria cases had been reported.

Forty three (43) 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 to enhance entomological surveillance to maintain malaria free status in the country.

The number of days spent for entomological activities are given in Table 8 and a total of 4509 days were spent by the central and regional entomological teams in 2016. Total number of entomology surveys carried out in 2016 by all entomological teams was 1203. Number of sentinel site monitoring was 496 and 707 surveys were carried out as spot checks and case based entomological surveys. The malaria case based entomological surveys were expanded by carrying out investigations for each malaria case (imported).

Two semiannual review meetings were conducted at national level to review the entomological surveillance activities carried out at regional level in 2016. Forty eight Health Entomology Officers were trained on standard operating procedures for entomological techniques in two in service programs conducted in Colombo.

District	Entomology days
Ampara	132
Anuradhapura	263
Batticaloa	169
Trincomalee	216
Hambantota	371
Kalmunai	187
Kandy	278
Monaragala	283
Rathnapura	236
Polonnaruwa	213
Kurunegala- A	155
Kurunegala –B	217
Maho	183
Matale	251
Puttalam	127
Kegalle	203
Badulla	189
Jaffna	183
Killinochchi	173
Mulathivu	224
Vavunia	212
Mannar	160
AMC HQ	276
Total	4901

Table 8: Total number of entomological surveillance days spent by entomological teams in 2016

The number of sentinel sites monitored was 54 in 51 MOH areas. Figure 5 shows the distribution of sentinel sites given by the cadjan hut locations of cattle baited hut trap technique.

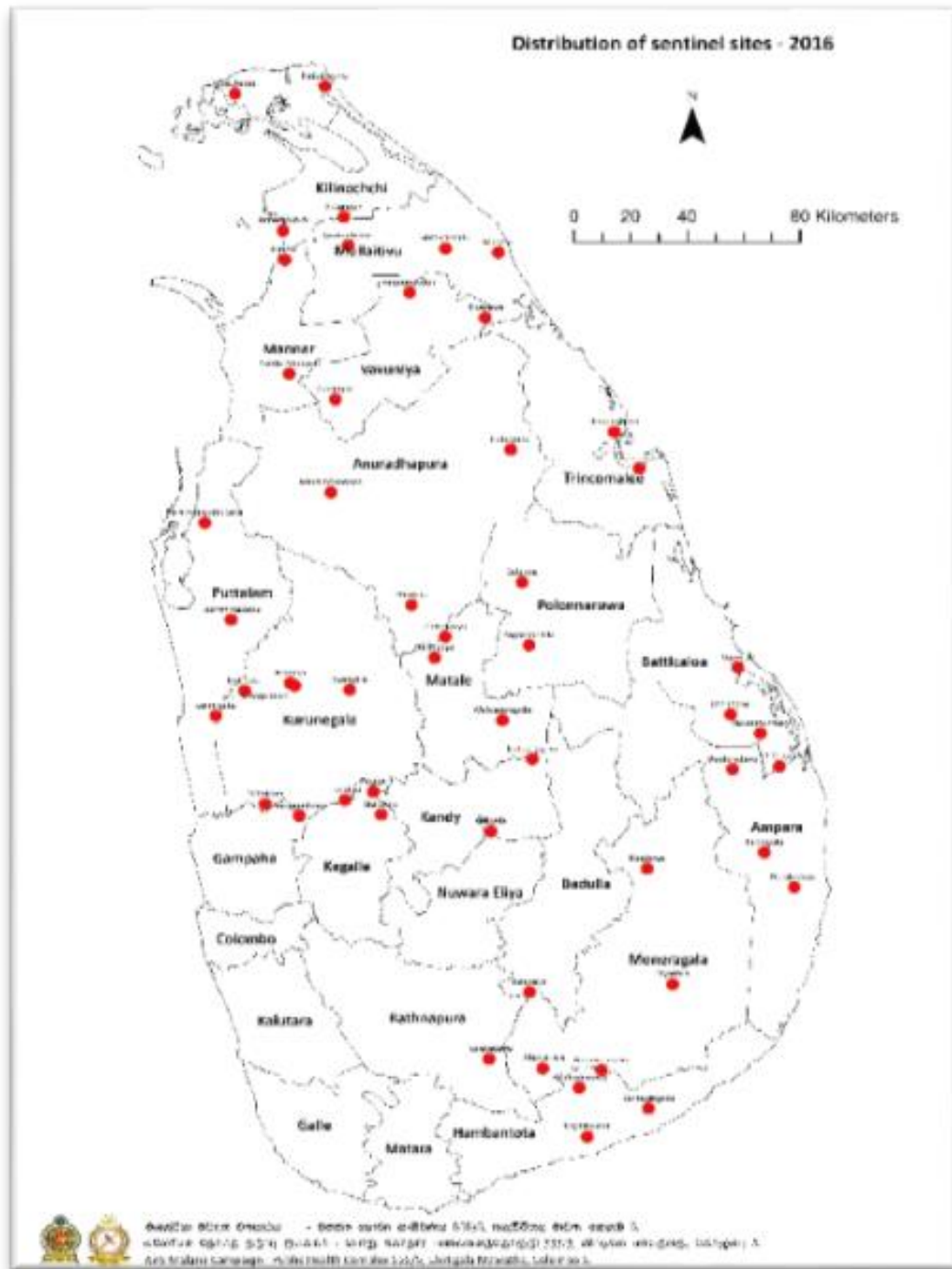


Figure 5 : Distribution of sentinel sites in 2016

The entomological surveys conducted in 2016

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 6 shows the total work output of larval surveys in total number of dips taken by entomological teams attached to RMO regions and AMC HQ in 26 RDHS areas.

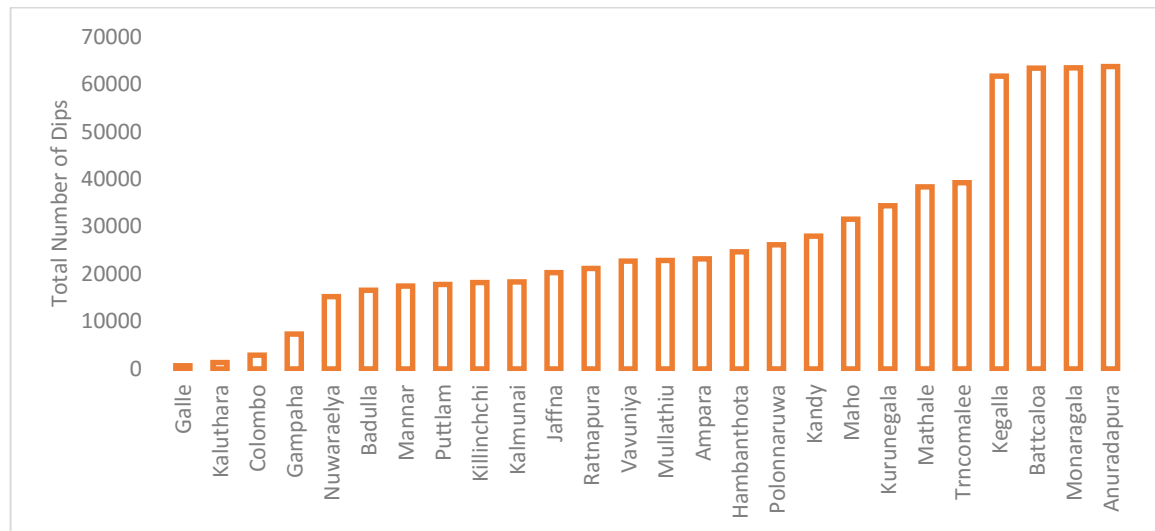


Figure 6 : Total Number of dips taken at each RDHS area in 2016

Breeding Habitats of malaria vectors

Figure 7 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 2016 indicate that the highest density of *Anopheles culicifacies* was found in river bed pools. Sand pools, rock pools and connected pools the main types of breeding sites contributes to breeding of *Anopheles culicifacies* breeding. Other breeding places were; temporary water collections like hoof prints, tire prints and wells, rain water collections. In 2016, the main breeding sites of secondary malaria vector *Anopheles subpictus* were temporary water collections like hoof prints, tire prints and abandoned brick and burrow pits. Main breeding sites of *Anopheles varuna* were river and stream margins while *Anopheles annularis* was abundant in tanks.

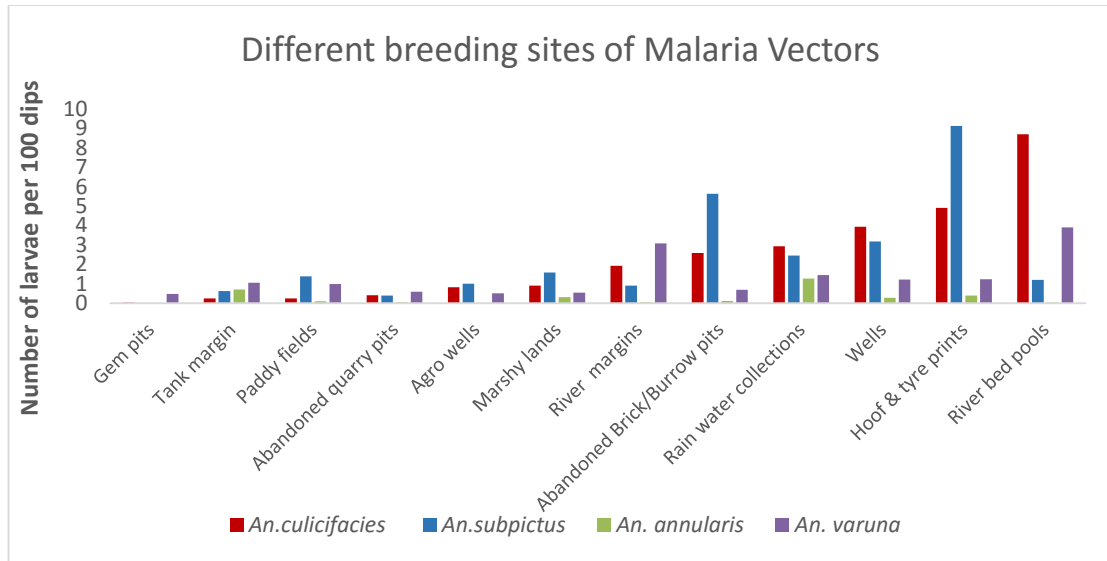
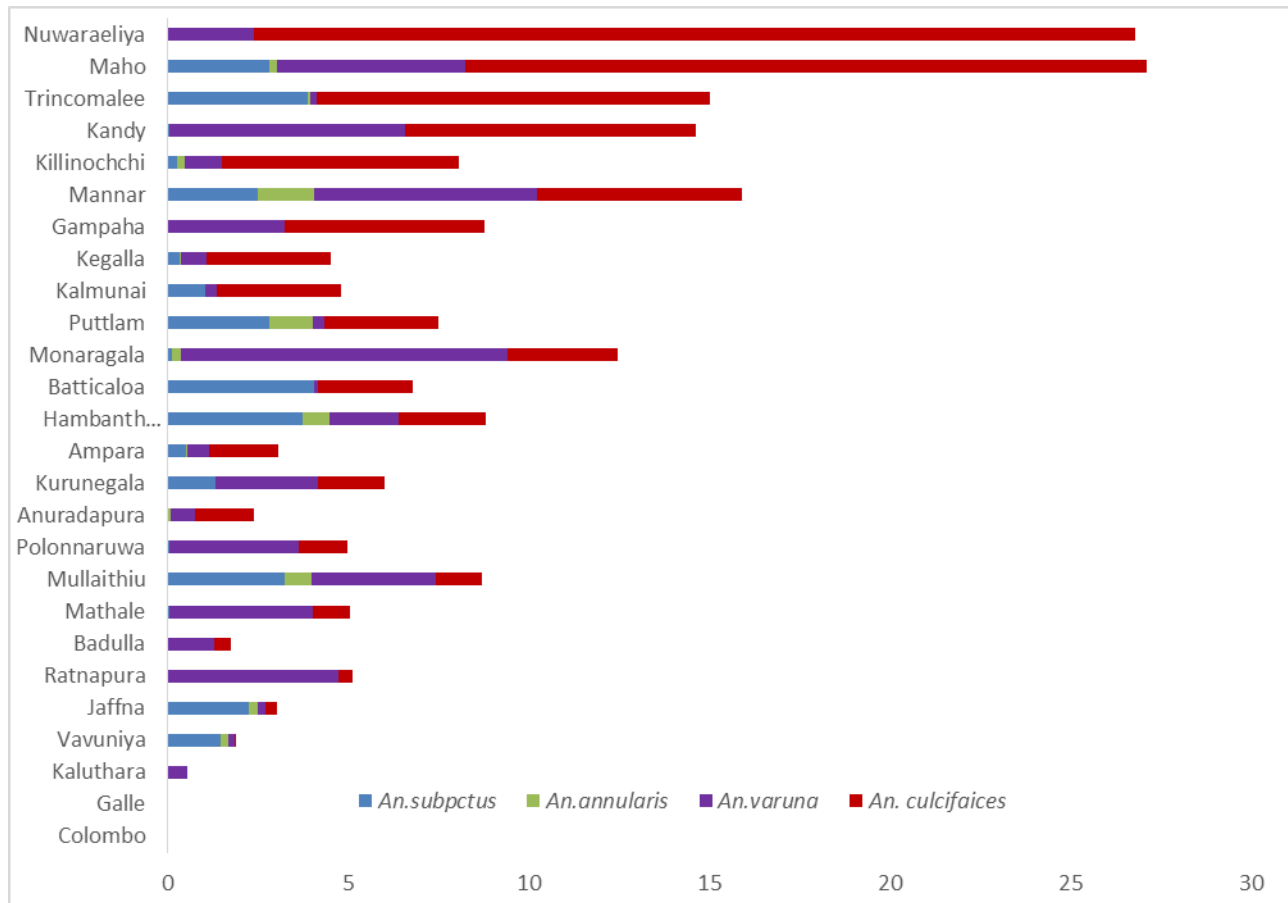


Figure 7: Relative density of major malaria vector larvae and secondary vector larvae in different breeding habitats

Larval Densities of malaria vectors

Figure 8 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, adjacent to Kandy / Nuwaraeliya border 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 8. Maho had the highest densities of vector larvae while Nuwaraeliya (sentinel sites adjoining Kandy/Nuwaraeliya border) and Mannar had the subsequent highest larval densities. Highest densities of *An. culicifacies* larvae was recorded from Nuwaraeliya (sentinel sites adjoining Kandy/Nuwaraeliya border), Maho and Trincomalee districts, whereas highest densities of *An. subpictus* was recorded from Baticaloa, Trincomalee, Hambanthota and Mullaitivu and districts.



* Nuwaraeliya indicates sites situated in Kandy/Nuwaraeliya border

Figure 8: Mean density of malaria vector larvae in Larval surveys in different districts 2016

First Record of *Anopheles stephensi* from Island of Mannar

Anopheles stephensi which was found for the first time in Sri Lanka from larval surveys carried out in Mannar district and confirmed by Anti Malaria Campaign Head Quarters by the end of 2016. *Anopheles stephensi* was found to be breeding in wells in Mannar MOH area. Figure 9 Depicts its first recorded localities Pesalai and Murugankovil of Mannar MOH area.

Location of study sits in Mannar district of Sri Lanka

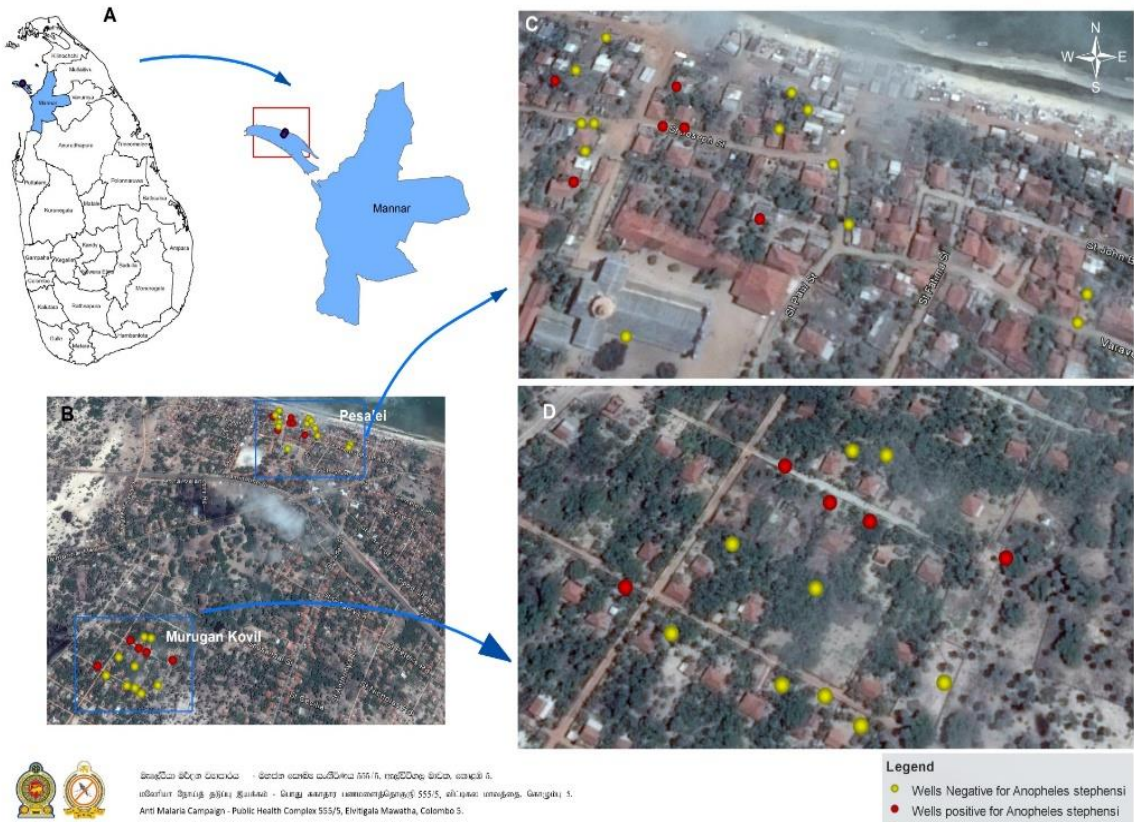


Figure 9: Map showing the first found two localities with *Anopheles stephensi* breeding in wells in Mannar District

According to the findings immediate vector control measures were started to control the new vector species. Entomological surveys were planned to continue vigilantly all over the country in coming years.

Cattle Baited Cadjan Hut Collections

Results of cattle baited hut technique is often used as an indicator for prevalence of indoor biting and resting vector populations. Figure 10 shows the total work output of cattle baited hut collections in different districts of Sri Lanka in 2016. Highest number of cattle baited cadjan hut collections were carried out in Hambanthota district followed by Moneragala and Mullaitivu districts.

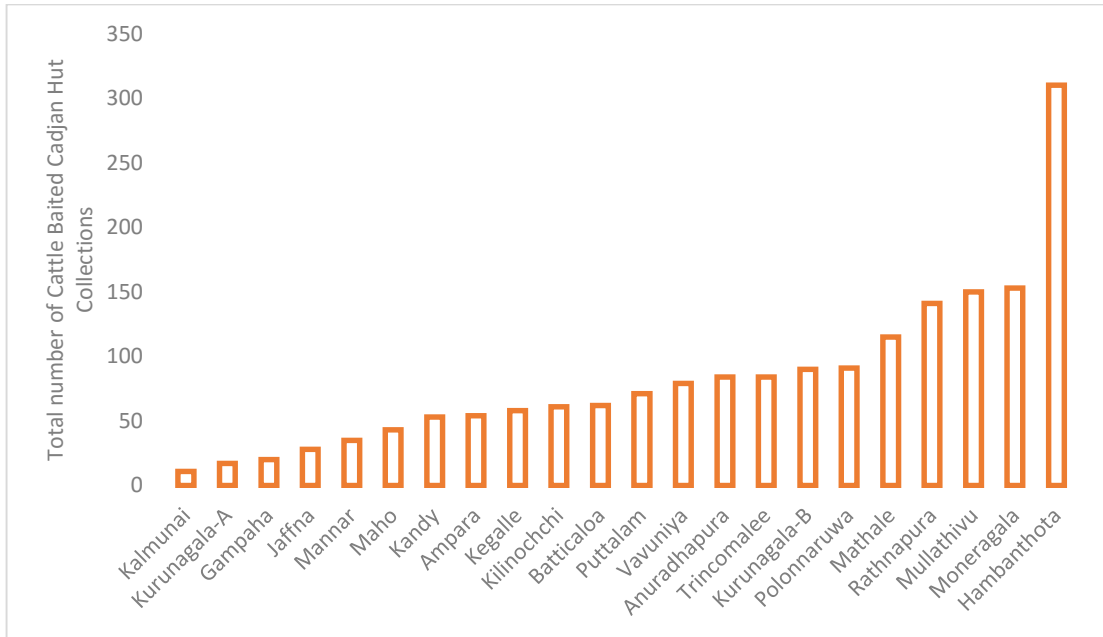


Figure 10: Total number of Cattle baited cadjan hut collections carried out in 2016 by districts

Figure 11 depicts the abundance of adult major malaria vector and secondary vectors in 22 RMO regions in 2016. Maho region of Kurunegala district recorded the highest density of adult females caught *An. culicifacies* in cattle baited cadjan huts followed by Batticaloa, Mannar and Moneragala. Highest density of *An. subpictus* was recorded by Polonnaruwa followed by Anuradapura, Moneragala and Kurunegala. *An. varuna* and *An. annularis* was recorded in low densities in cattle baited huts in 2016.

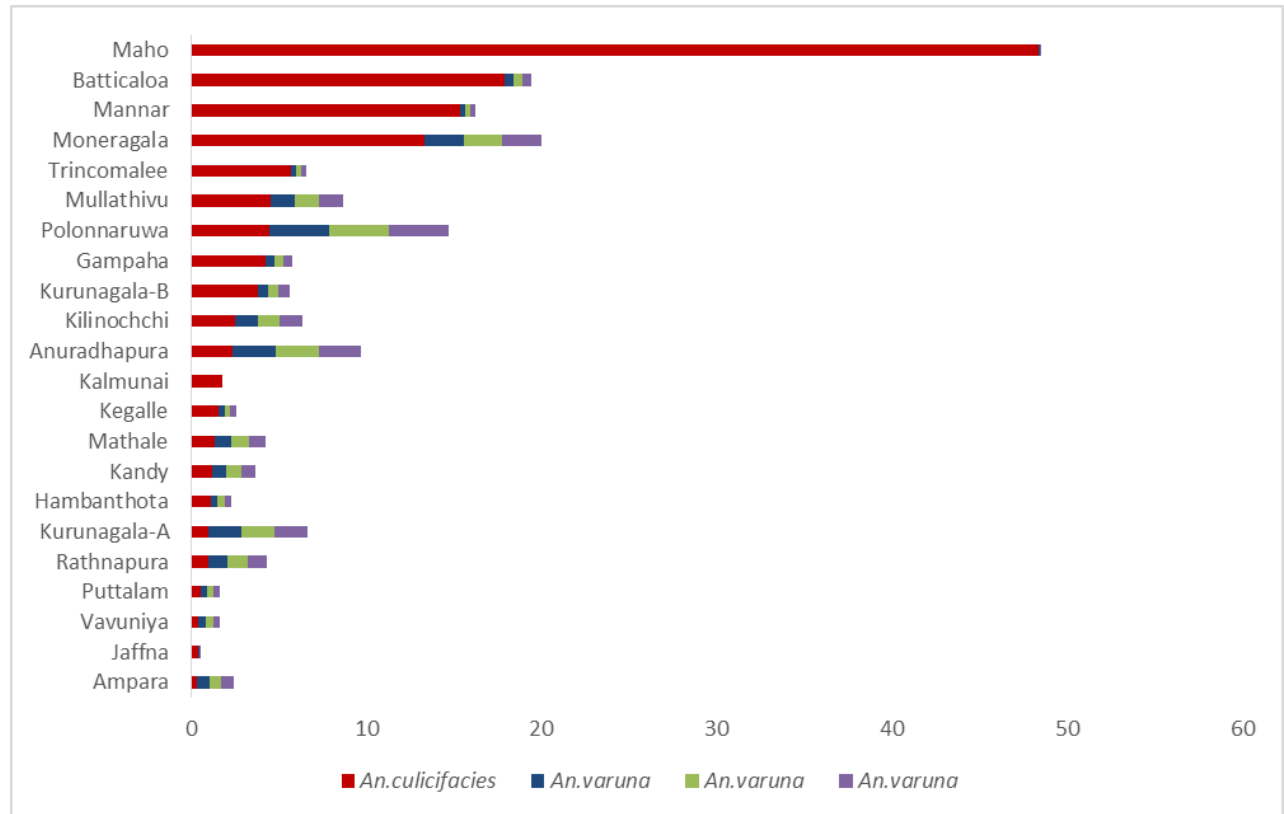
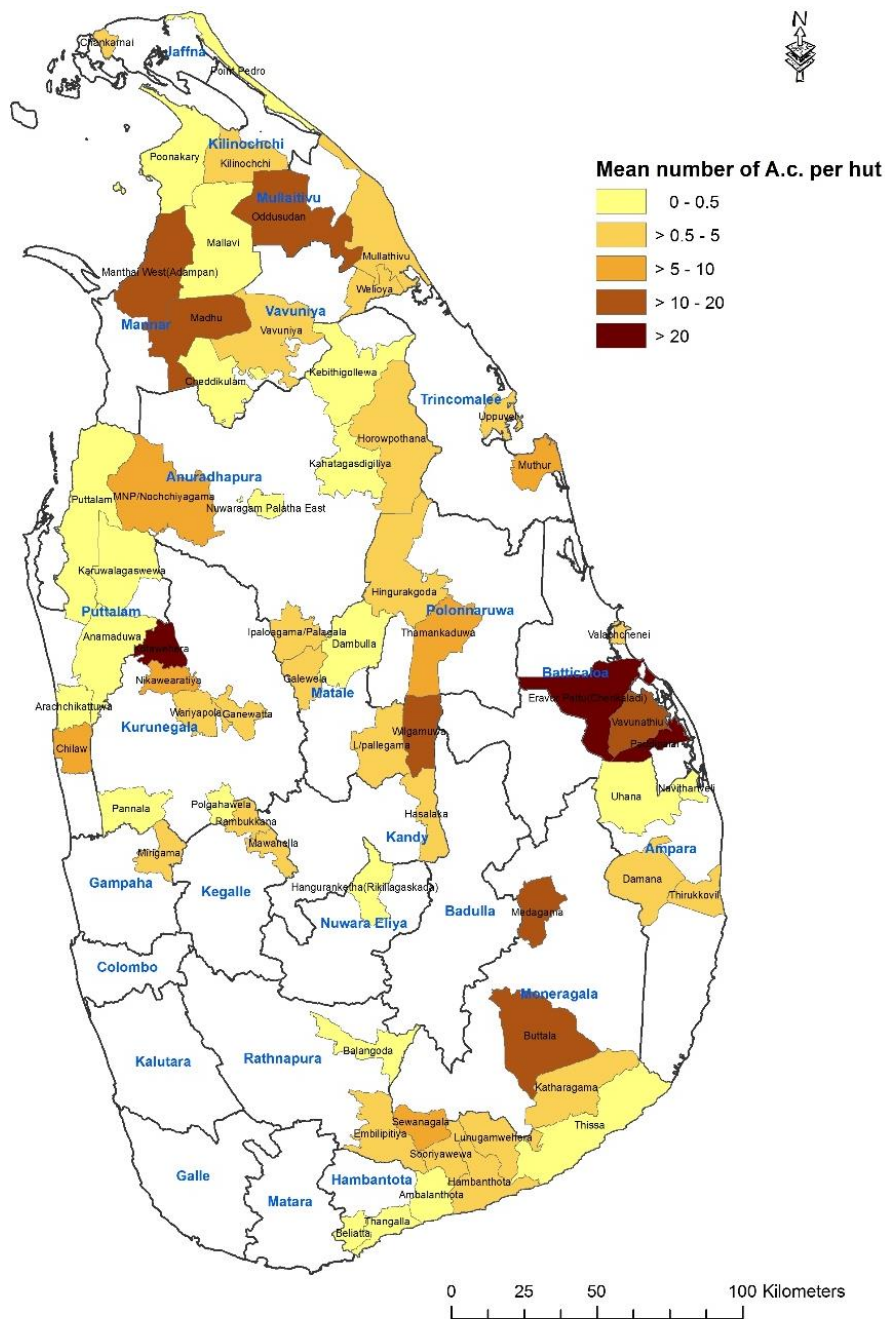


Figure 11: Mean density of malaria vector females caught in cattle baited trap collections in 2016 by districts



මෙහිදී මෙහි චිත්‍රය - මහජන සෞඛ්‍ය සංවිධානය 555/5, එල්ටීවීලේ මාරු, කොළඹ 5.
 மலேரியா தடுப்பு திட்டம் - சமூக சுகாதார பண்பணத்தொகுதி 555-5 இல் விட்டியை மாவாத்த, கொழும்பு 5.
 Anti Malaria Campaign - Public Health Complex 555/5, Elvitigala Mawatha, Colombo 5.

Figure 12: Map showing mean densities of *Anopheles culicifacies* caught in CBHC in different MOH areas in 2016

Figure 12 shows the mean density of major vector adults caught by cattle baited huts in 51 MOH areas which were considered as sentinel MOH areas. Maho and Chenkaladi MOH areas had the highest mean adult female density of *Anopheles culicifacies* having a density of more than 20 females per hut.

Cattle Baited Trap Collections 2016

Results of cattle baited hut technique is often used as an indicator for prevalence of outdoor biting *Anopheles* mosquito populations. Figure 13 shows the total work output of cattle baited trap collections in Sri Lanka.

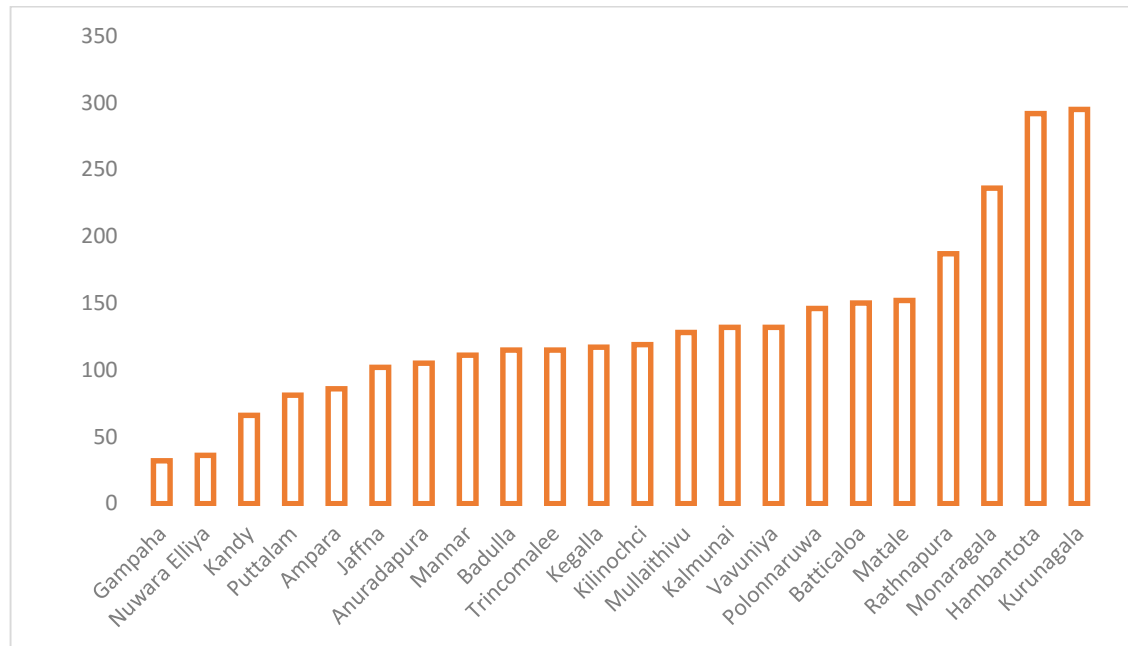


Figure 13: Total work output of cattle baited trap collections in 2016

Figure 14 depicts the abundance of adult major malaria vector and secondary vectors caught cattle baited trap collections in 22 RMO regions in 2016. Trincomalee district recorded the highest density of adult females vectors in cattle baited traps followed by Moneragala and Jaffna districts. Highest density of *An. subpictus* was recorded by Trincomalee 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 2016.

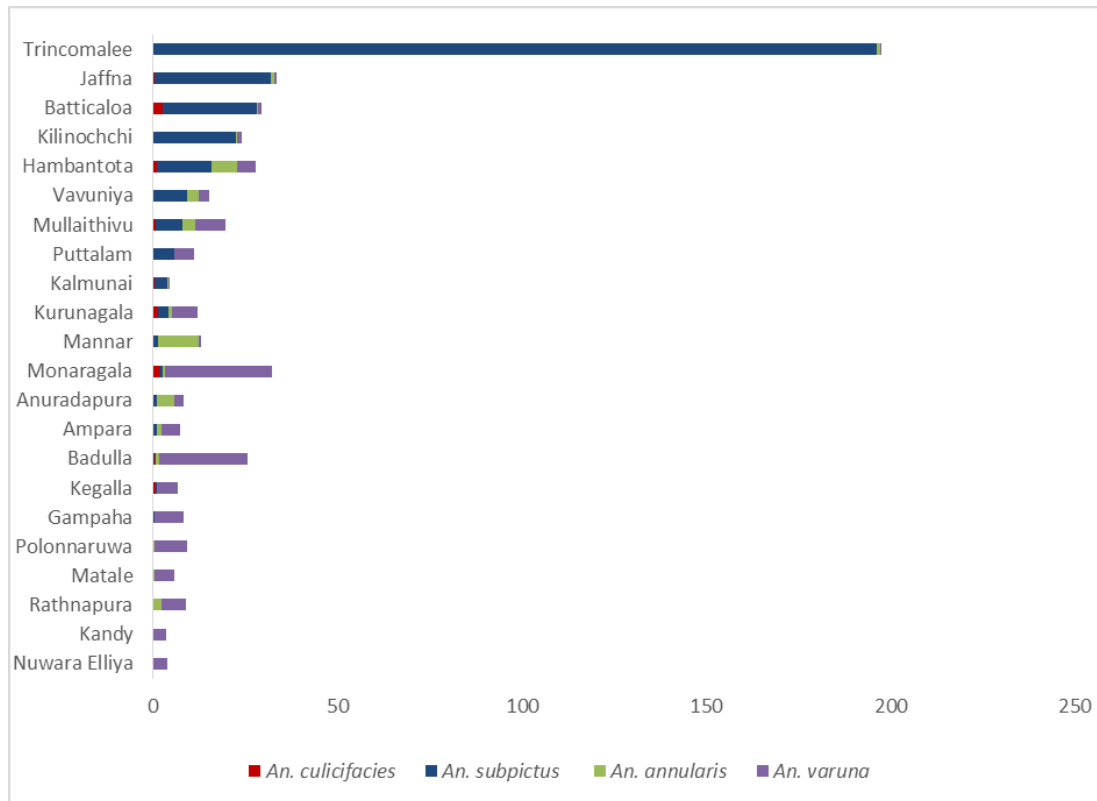


Figure 14: Mean density of malaria vector females caught in cattle baited trap collections in different districts 2016

Indoor Hand Collections

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.

Highest number of houses inspected for indoor resting mosquitoes was done in Hambantota region followed by Batticaloa, Maho and Trincomalee regions. Major malaria vector *Anopheles culicifacies* was recorded in very low densities in majority of regions. Highest indoor resting habit was found in Maho and Kurunegala B regions. Highest indoor resting density of secondary vector *Anopheles subpictus* was found in Batticaloa region.

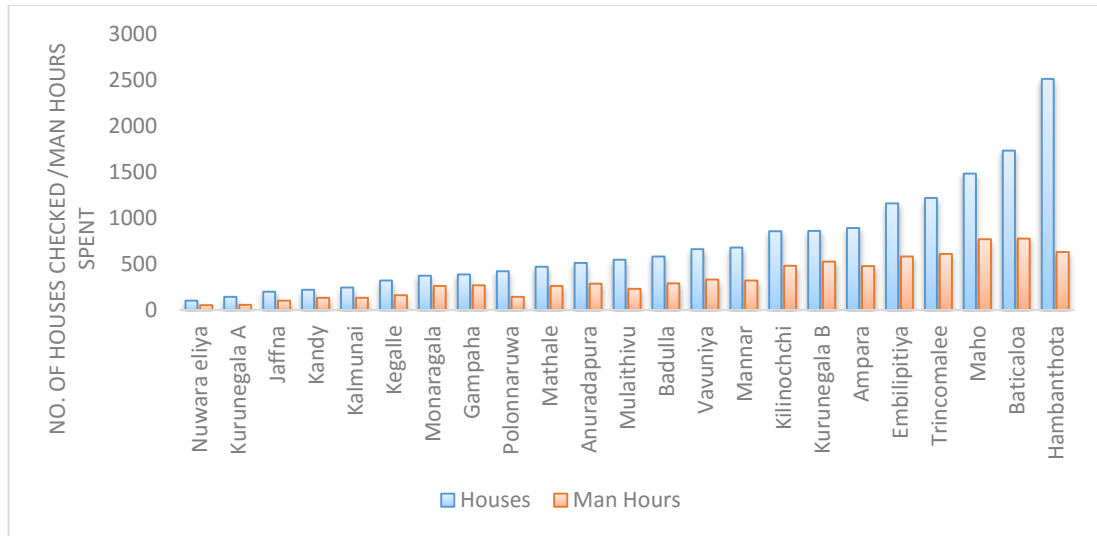


Figure 15: Work output of indoor hand collection technique in different RMO regions

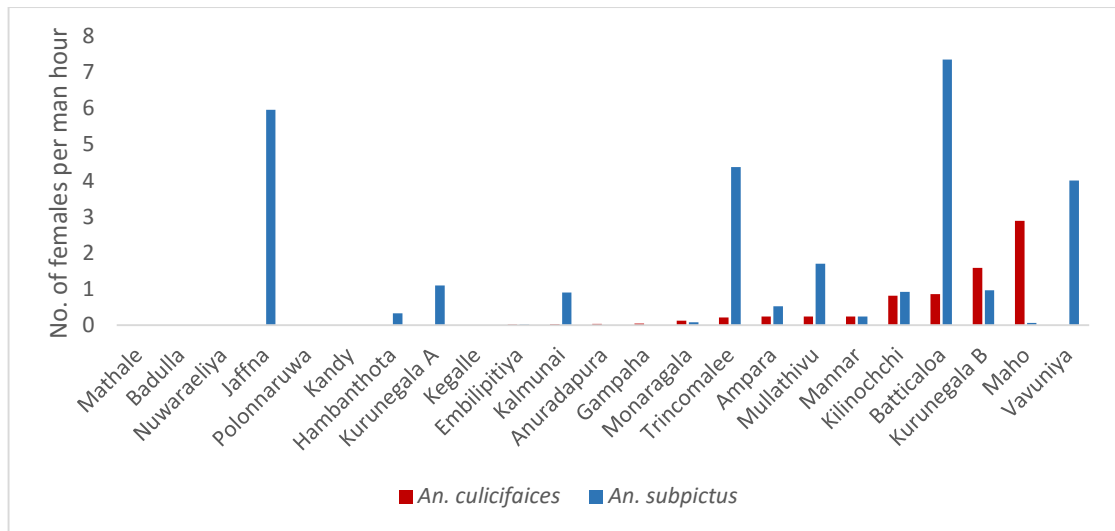


Figure 16: Mean density of An. culicifacies and An. subpictus indoor resting densities

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.

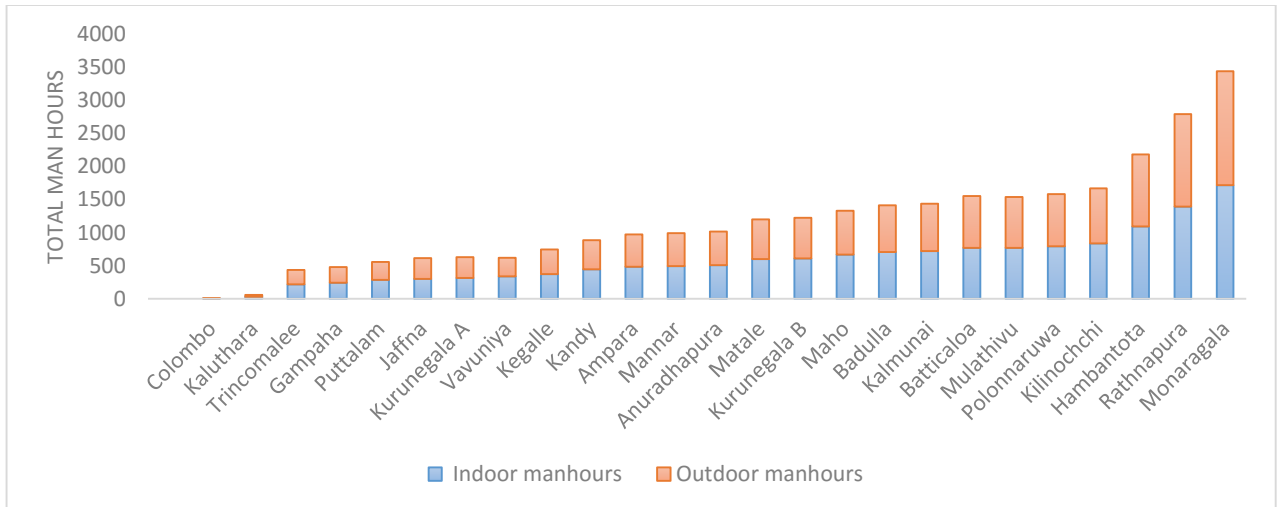


Figure 17: Total man hours spent in different regions in human landing catches in 2016

Figure 17 shows the total work output of human landing catches spent in man hours in different regions. Moneragala, Ratnapura and Hambantota regions have spent the highest total man hours indoor and outdoor.

Biting Preferences of Malaria Vectors

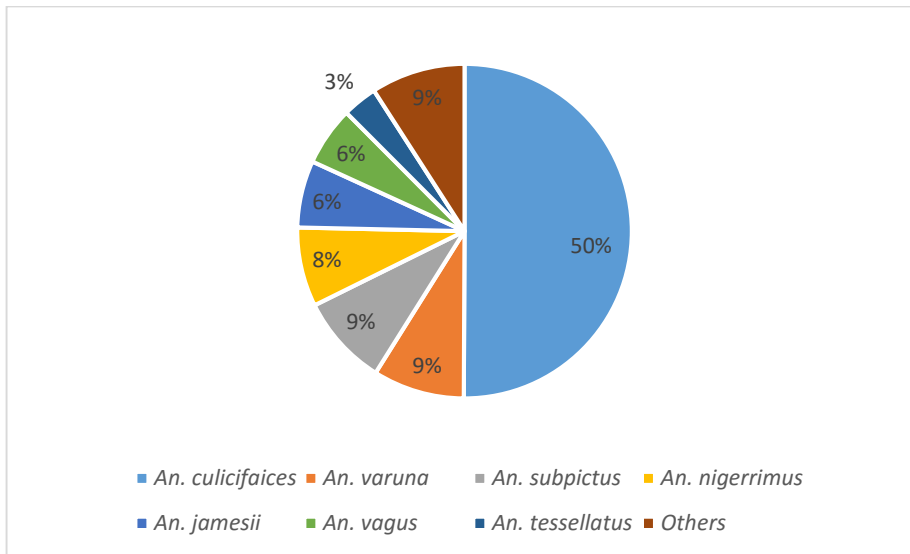


Figure 18: Percentage of human biting preferences of Anopheles species caught during partial night human landing catches

Despite the malaria eliminated situation in the country the human landing catches were continued to assess the risk of malaria transmission. *Anopheles culicifacies*, the primary malaria vector was found more abundantly (50%), followed by *Anopheles varuna* (9%), *Anopheles subpictus* (9%) and *Anopheles nigerrimus* (8%). The other noticeable human biting species were *Anopheles tessellatus*, *Anopheles vagus* and *Anopheles jamesii* (Figure 18).

Insecticide Resistance Monitoring

Resistance in main and potential malaria vectors for four classes of insecticides were tested in 2017 according to WHO standard method. Results for *Anopheles culicifacies* and *Anopheles subpictus* are shown in the table 9. Main malaria vector *An. culicifacies* has shown possible resistance to Permethrin 0.75% and confirmed resistance to Fenitrothion 1%.

Table 9: Insecticide resistance monitoring

Insecticide & concentration	<i>An. culicifacies</i>			<i>An. Subpictus</i>		
	Susceptible	Possible resistance	Confirmed Resistance	Susceptible	Possible resistance	Confirmed Resistance
Bifenthrin 0.2%	Madagama Kotawehera					
Deltamethrin 0.05%	Chilaw Kotawehera Medagama			Poonakary Palai Valaichenai, Paddipalai		
Lambdacyhalothrine 0.05%	Vavunathivu, Chilaw Rikillagaskada Madu Medagama Paddipalai Kotawehera Chilaw			Vavunathivu Paddipalai Batticaloa Vaharai Point pedro Tangalle	Valaichenai	Muthur
Permethrin 0.75%	Vavunathivu,	Kotawehera		Paddipalai, Kaluvanchikudy		
Malathion 5%				Paddipalai	Muthur	
Fenitrothion 1%			Medagama	Hambanthota		
Propoxur 0.1%	Lunugamwehera					
DDT 4%						Paddipalai Muthur

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 for Indoor Residual Spraying (IRS), distributing Long Lasting Insecticide treated Nets (LLINs), introduction of laviorous fish, environmental modulation and modification and space spraying for special occasions.

District	Quantity of insecticides issued			
	Abate(Temphos) 50% (l)	Lambda- cyhalothrin 10% (drum)	Pesguard(l)	Cyfluthrin(box)
Colombo	200	19	100	111
Gampaha	-		-	-
Kalutara	-		-	-
Kandy			2	1
Matale	5	1	2	2
N' Eliya	-		-	-
Galle	-		-	-
Matara	-		-	-
Hambantota	5	5	5	2
Jaffna	5		2	2
Killinochchi	5		2	2
Vavuniya	5		2	2
Mannar	5		2	2
Mullativu	5		2	2
Batticaloa	5	1	2	
Ampara	5	2	2	
Kalmune	5	2	7	2
Trincomalie	5		2	2
Kurunegala A&B	10	2	9	4
Maho	5		2	2
Puttalam	5	1	2	2
Anuradhapura	5	1	2	2
Polonnaruwa	5	1	2	2
Badulla	5	1	2	
Moneragala	-	1	2	2
Ratnapura	5		2	
Kegalle	5		2	2
Total	300	18+19	57	35

Table 10: Insecticides distributed to regions by AMC/HQ during 2016

Table 10 shows the insecticides that had been distributed to regions during the year 2016, for the spraying and maintaining the buffer stocks.

RMO Office	Insecticides used			
	Abate EC	Abate SG	Cyfluthrine	Pesgud
Anuradhapura	0.75	5	300	15.5
Ampara	1.25	53.58	60	4.75
Badulla	0	0	0	0
Batticaloa	0	0	0	0
Rathnapura				
Hambanthota	0	22.5	600	6
Jaffna	0	0	0	0
Kurunegala A	3	2	0	22
Kurunegala B	0	2	0	12
Kilinochchi	3.06	0	0	3
Kandy	0.84	2	4	13
Kegalla	0	0	0	0
Kalmunie	15	1185	40	104
Maho	0	20	0	0
Mathale	10.36	126.5	79	10.7
Monaragala	6.8	0	0	2.05
Mulathive	0	0	0	4.8768
Mannar	9	10	120	4
Polonnaruwa	0	0	0	2.82
Puttalam	0	13	0	11
Trincomalee	20	91	0	40
Vavunia	0	10	25	5

Table 11: Insecticides usage in different districts for indoor residual spraying during 2016

Table 11 shows the insecticides that had been used for indoor residual spraying in different districts. During the year 2016, the total number of houses fully sprayed was 28,675, partially sprayed was 3,417 and the total population covered was 119,385.

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

Table 9 shows the district wise distribution and usage of Long Lasting Insecticide treated Nets (LLINs) during 2016.

District	No. of LLIN distributed by AMC/HQ to RMOO	No. of LLIN Distributed by RMO
Ampara	1200	1358
Anuradhapura	440	459
Badulla	1200	0
Hambantota	1000	5040
Batticaloa	0	1078
Jaffna	200	250
Kalmunie	0	476
Kandy	1200	1564
Kegalle	280	3101
Kurunagal A	1000	0
Kurunagala B	800	2092
Kilinochchi	0	3551
Maho	1200	2101
Mannar	1200	78
Matale	880	0
Monaragala	880	35
Mullaitivu	1200	670
Polonnaruwa	1000	1032
Puttalam	920	440
Ratnapura	1000	0
Trincomalee	0	5049
Vavuniya	800	0
Total	16400	29412

Table 9: Distribution of Long Lasting Insecticides Treated Nets (LLIN) for Malaria prevention of re-introduction during 2016 by districts

Infrastructure and Human Resources

At the end of year 2016, 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 2016.

	Approved at 31.12.2013	In position
Director	1	1
Deputy Director	1	0
Consultant Community Physician(Medical Consultant)	3	3
Medical Officer	5	4
Accountant	1	0
Entomologist	4	2
Parasitologist	1	1
RMO / AMO (Registered/Assistant Medical Officer)	1	1
Special Grade Entomological Assistant	1	0
Special Grade PHLT	2	0
Health Entomological Officer	6	6
Medical Laboratory Technologist	3	1
Public Health Inspector	2	3
Public Health Laboratory Technician	22	10
Information & Communication Technology Assistant	2	1
Health Education Officer	1	0
Information & Communication Technology Officer	1	0
Development Assistant	4	4
Medical Record 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	10
Health Laboratory Aide	3	2
KKS	1	1
Lift Operator	2	2
Saukya Karya Sahayaka(Junior)	20	10
Saukya Karya Sahayaka (Ordinary) -A'pura	25	18
Saukya Karya Sahayaka (Ordinary)		10
Spray Machine Operator	19	5
Development Officer	5	6
Saukya Karya Sahayaka (Junior) Casual	0	7
Pharmacist	1	0
Technical Officer (Civil)	1	0
Generator Operator	1	0
Pumber/ Pumb Machine Operator	1	0
Total	195	123

Table 12: Staff position at Anti Malaria Campaign Headquarters during 2016

Vehicles

Serial No	Vehicle No	Type of Vehicle	Working Condition
1	WP PE 8966	CAB	Running
2	WP GP 2558	VAN	Running
3	WP GP 2556	VAN	Running
4	42 – 9399	MOTOR LORRY	Running
5	WP LC-0249	MOTOR LORRY	Running
6	WP NA 3117	VAN	Running
7	WP NB 4568	VAN	Running
8	WP NB 4567	VAN	Running
9	WP JL 8129	CAB	Running
10	WP PE 8975	CAB	Running
11	WP PE 8974	CAB	Running
12	WP PE 8972	CAB	Running
13	WP PF 2025	CAB	Running
14	WP AAD 0185	TRICYCLE	Running
15	WP WF 5034	MOTOR BICYCLE	Running
16	WP PF 9419	CAB	Running
17	32 – 6520	PAJERO	Not Running

Table 13: Availability of vehicles in AMC/HQ during 2016

Adequate number of vehicles in good condition is an important factor in effective programme to prevent re-introduction of malaria. The table 13 shows the available number of vehicles in AMC headquarters In 2016 .

Anti Malaria Medicines

A buffer stock of antimalarial medicines to face any emergency is available in the Headquarters.

The following table shows the distribution of drugs for districts in the year of 2016.

	Choloroquine Phosphate	Primaquine phosphate	Quinine Sulphate	Quinine Dihydrochlori	Coartem-G	Coartem-O	Coartem-B	Coartem-Y	Artesunate Injection
Ampara	6000			60				12	2
Anuradhapura	1420	2000	20	40				8	6
Badulla	3000	1000							20
Batticaloa	4500	1250	50	70	7			8	
Hambantota	2600	250	50	40	5		4		4
Jaffna	5150	1130	90	59	3			3	9
Kandy	500	1500		90	10			8	
Kalmunai	1000			20	9			2	4
Kegalle	3000	250	50		3			2	
Kilinochchi	1800	200	20	50	6			5	5
Kurunagala A	1500	1100	10	25					4
KurunagalaB	1500	1750	70	30	3			3	
Maho	1000	250	50	30	3			3	10
Mannar	1000	250	10	20	4			4	4
Monnaragela	4000	500	10	20	3			4	9
Mullaitivu	1000		100	80				5	
Polonnaruwa	4000	1000		40					3
Putta	1000	1250	50	50	3			3	
Trincomalee	3782		20						15
Vavuniya	1000		25	20					14
AMC/HQ/MO	3000	1140		60	25			11	50

Table 14: Distribution of Anti malaria medicines by AMC/HQ to districts in the year of 2016

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.

Funding

Government of Sri Lanka allocates fund for Anti Malaria Campaign through Ministry of Health, Nutrition and Indigenous Medicine. In 2016 the budget allocation to AMC/HQ was SLR 130,716,826.74 and the expenditure was SLR 110,938,551.37(84.87%). In addition provincial malaria activities were funded by provincial ministries.

Foreign Funded Projects

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

The GFATM (Global Fund to fight Aids, Tuberculosis & Malaria) is a collaborative partner with the Anti Malaria Campaign through the New Funding Model cycle for the period 2016 to 2018.

The programme was designed in four modules to 1) Case Management 2) Vector Control 3) Health Information Systems and Monitoring & Evaluation 4) Program Management. This structure supported the strategies employed for elimination and prevention of reintroduction through interventions for maximum impact.

The interventions include diagnosis and follow up of malaria cases, facility based surveillance and surveillance through Mobile Malaria Clinics, Entomological surveillance, Vector control, Procurement of Health and Non Health products and Equipment, Infrastructure development, IT development and procurement, Capacity building through training programs and IEC/BCC activities through awareness programs, printing and publication of material and bill boards at Ports of entry.

A Performance framework with indicators that measure impact, outcomes and outputs with work plan tracking measures facilitate monitoring and evaluation of the programme annually. The AMC received an 'A' grading in 2016 programmatic activities by the Global Fund which reflects an exceptional programme performance.

The table below indicates the key performance indicators and status of the grant for 2016.

Indicator	Target (%)	Result	%
CM-2a: Proportion of confirmed malaria cases that received first-line antimalarial treatment at public sector health facilities	100	N: 29 D: 29 P: 100%	100
CM-2c: Proportion of confirmed malaria cases that received first-line antimalarial treatment according to national policy at private sector sites	100	N: 12 D: 12 P: 100%	100
CM-5: Percentage of confirmed cases fully investigated and classified	100	N: 41 D: 41 P: 100%	100

N:Numerator,D:Denominator ,P:Percentage

Table 15: Key performance indicators and status of the grant for 2016

The budgetary allocation of USD. 3,201,500 for 2016 covered fifteen interventions designed to prevent the reintroduction of malaria to Sri Lanka.

Expenditure as at 31st December 2016 amounted to USD 775,574, which was 24% of the annual grant allocation. Expenditure carried forward as accrued payments, ongoing activities and activities shifted to 2017 amounted to USD. 1,415,434.46.

Preparation for the WHO certification process as a malaria free Sri Lanka was a rigorous exercise which consumed much time and other resources in the initial nine months of 2016 and except the routine activities related to surveillance, awareness other procurement and programs were delayed

Assistance from the World Health Organization (WHO)

WHO is committed and continues to support the Anti Malaria Campaign, Ministry of Health, Nutrition and Indigenous Medicine to keep Sri Lanka malaria free. In the year 2016 the following activities were carried out through WHO funding.

WHO Advocacy and capacity building programs conducted to improve clinical management, entomology and microscopy

One entomological assistant was trained on regional training on vector entomology for one week under WHO office direct funding.

Funds were allocated for the clinician's capacity building programs at Western, Central, North West and Southern Provinces. Four such programs were conducted using SLR 146,940 in 2016.

WHO Malaria Elimination Certification

Sri Lanka is the second country in the WHO South-East Asia Region to eliminate malaria after Maldives. The announcement of Sri Lanka's victory over malaria was made at the WHO South-East Asia Region's annual Regional Committee meeting in the presence of health ministers and senior health officials from all 11 Member States.

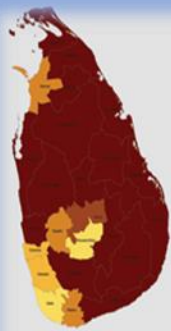
Technical and financial assistance were provided by the WHO /Sri Lanka for preparing the country for WHO certification process, mainly improving documentation and standardization of record keeping process in the early part of 2016 which included meetings, trainings, field supervisions, and debriefing meetings with WHO expert teams. Two international expert teams visited Sri Lanka in November 2015 and May 2016 for assessment and guiding AMC on further improvements. Final independent evaluation was conducted by Prof Rossitza Kurdova-Mintcheva, Dr Kevin Palmer, Dr Cecilia Hugo & Dr Chandrakant Revankar during 26th July – 11th August 2016. After a rigorous evaluation procedure which included field visits to all four corners of the country, the team recommended certifying Sri Lanka as a malaria free country. The National ceremony for Declaration of certification on elimination of malaria was conducted in 30th November 2016 at the WHO Regional Committee for South-East Asia held in Colombo. The WHO has supported AMC with SLR 810,761.24 for malaria elimination and PoR activities in the year 2016.



Figure 19: Receiving Malaria Free certificate at the National ceremony for Declaration of certification on elimination of malaria



Figure 20: The audience at the National ceremony for Declaration of certification on elimination of malaria



Malaria killed hundreds of thousands of Sri Lankans in the past.



From 2009 Sri Lanka embarked on the malaria elimination.



For the first time Sri Lanka has been free of malaria since 2012 November.



WHO Certified Malaria Free in Sri Lanka in 2016 September.

Keep Sri Lanka
Malaria **Free**

Remember! **Malaria**
Can Come Again