Mosquito borne disease: Challenges, Surveillance and Control in the Caribbean UK Overseas Territories

Vaux, A.G.C.[1], Abbott, A.[1], Alexander, H.[2], Aymer, K.[3], Fleming, A.[4], Handfield, Z.[5], Hardy., H.[1], Hodge, M.[4], Johnston, C.[1], Robinson, A.[5], Rogers, K.[4], Stanley, G.[3], Taylor, R.[1], Wilson, D.[5], White, C.[2], and J.M. Medlock[1].

UK Health Security Agency

INTRODUCTION

UKHSA Medical Entomology provides technical expertise and support to the UK Overseas Territories, in order to develop capacity and capability within the vector control teams, usually part of the Environmental Health Department. Anguilla, British Virgin Islands, Montserrat, and the Turks and Caicos Islands, all have unique opportunities and challenges in terms of vector surveillance and control, with particular focus on preparedness for outbreaks of dengue, chikungunya, and Zika viruses, and their vectors *Aedes aegypti* and *Aedes albopictus.* This poster sets out some of the key challenges of vector control, and summarises key aspects of the longstanding collaboration between UKOTs and the UKHSA Medical Entomology group. Funded by the FCDO, focus has been given to needs assessments, surveillance training and capacity building, and development of targeted control strategies targeting *Aedes* vectors.

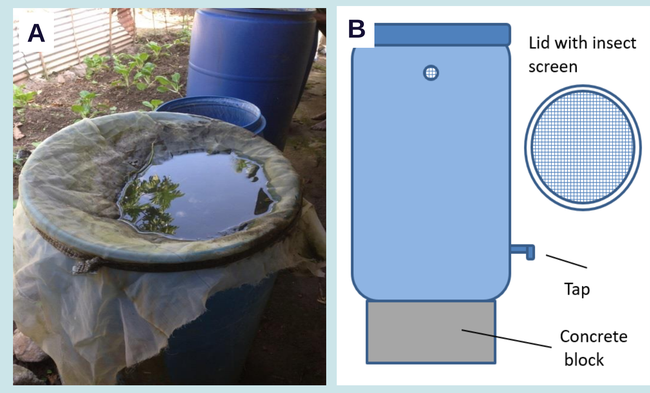
KEY CHALLENGES

There are number of key areas and challenges that are critical for a successful vector control programme to address.

1. **Management of water systems**. Identifying dominant larval habitats - container habitats (eg: drums, cisterns, discarded waste) are essential for *Aedes aegypti* larval habitats.
2. **Management of waste systems.** A key intervention of disaster and outbreak resilience to mosquito-borne disease is waste management, engaging at all spatial scales - individual, communities, national actions.
3. **Vector Surveillance and Control**. Developing data driven vector control practices – trap-based surveillance, adult indices, digital recording and data management.
4. **Empowering the workforce** through training and development
5. **Outbreak mosquito control** – targeted source reduction and use of residual insecticides focussed around cases.
6. **Management of marsh mosquitoes** – development of ecological solutions to mosquito control.

CASE STUDY: DRUM COVER INTERVENTION

Many Caribbean islands utilise plastic drums for water storage, particularly for garden watering. In Montserrat, vector control have long focused efforts educating the community on ensuring drums are covered to prevent mosquito access but recognized that a better solution has been needed. Modification of drums through retrofitting and fitting a mosquito screen to the lid and overflow has been used effectively in Dominica.



Wire mesh, taps and other consumables were purchased and delivered to Montserrat. The Vector Control team advertised the initiative on social media and the radio, and have now modified over 500 drums across the island.

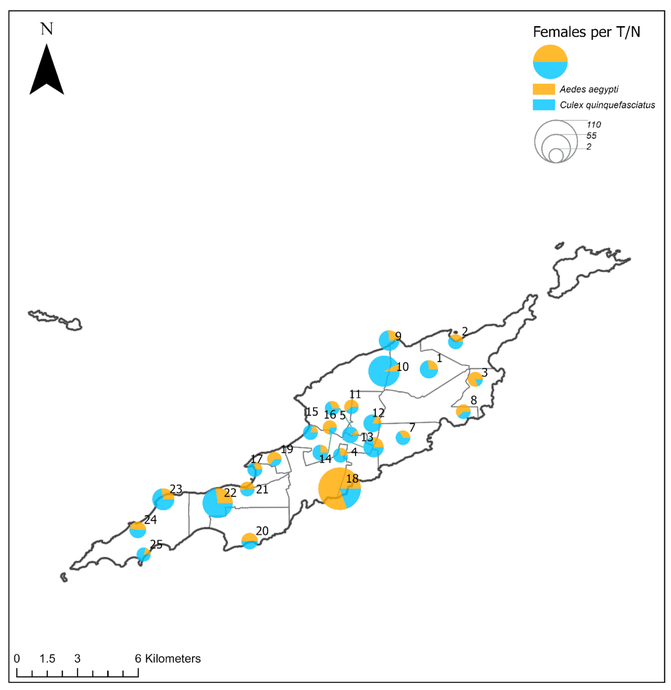
Figure 1: A = Drum with makeshift cover, failing to prevent larvae breeding. **B** = Diagram of drum modification. **C** = Modified drum. **D** = Map of modified drums (size of circle = # modified drums; colour = year modified).

TRAP-BASED SURVEILLANCE

Developing capability within Vector Control teams to conduct trap-based surveillance has been a key aim. Vector Control teams in the Caribbean traditionally conduct house-to-house surveys across the islands, in order to engage with local residents and provide indices (eg: house / container / Breteau) of mosquito numbers. Whilst this is useful, trap-based surveillance can provide more useful data on adult mosquito abundance, can encourage Vector Control Officers to develop skills in mosquito trapping and identification, helps identify a range of mosquito species present, and can enable the production of maps in order to target mosquito control resources to *Aedes aegypti* hotspots.

Using BG-Sentinel traps, trapping has been conducted in Anguilla, British Virgin Islands, Montserrat, and the Turks and Caicos Islands. Traps are placed for up to 2 weeks, and mosquitoes identified to species. This 'snapshot' survey can then be repeated each quarter, to enable understanding of seasonality and impact of control interventions.

Figure 3: Left - Adult mosquito survey snapshot from TCI, showing Providenciales, the largest of the five islands. **Right** – photos of setting BG-Sentinel 2 traps.



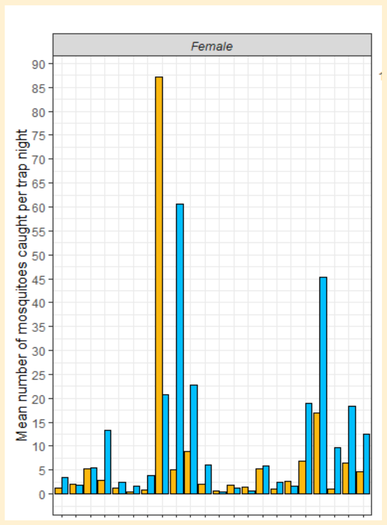


Figure 2: Anguilla. **Left** - snapshot survey showing density (females per trap night [F/TN]) of *Cx. quinquefasciatus* and *Ae. aegypti.* **Right** – *Ae. aegypti* F/TN by site.

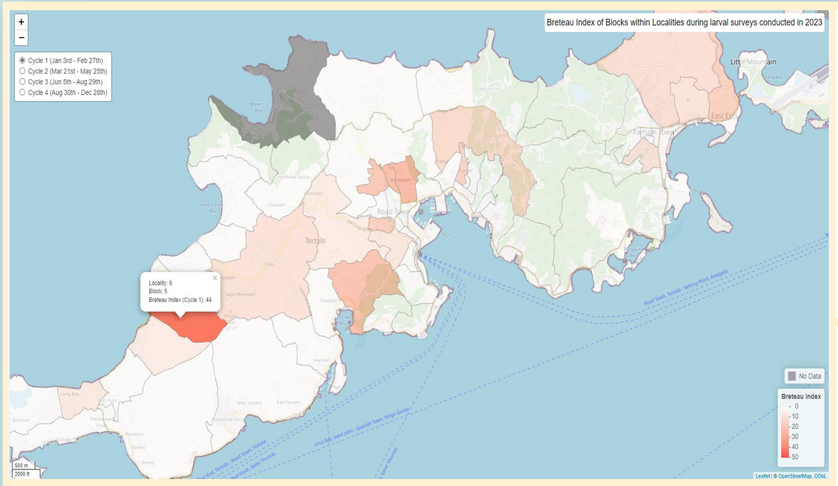
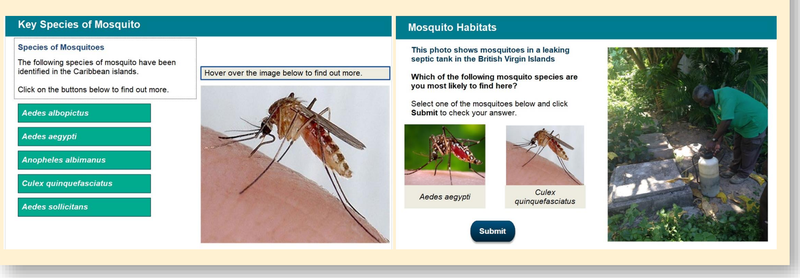


Figure 4: British Virgin Islands. Left – Map of Tortola, BVI, showing localities shaded by Breteau larval index value. Maps are used for community engagement and to target vector control resources. **Top Right** – Mean number of (**A**) *Ae. aegypti* [F/TN] and (**B**) *Cx. quinquefasciatus* shown by Trapping Cycle (1-3) and Locality (1-11). **Bottom Right** – Rainfall (mm) by Month showing timing of Trapping Cycles (1-3).

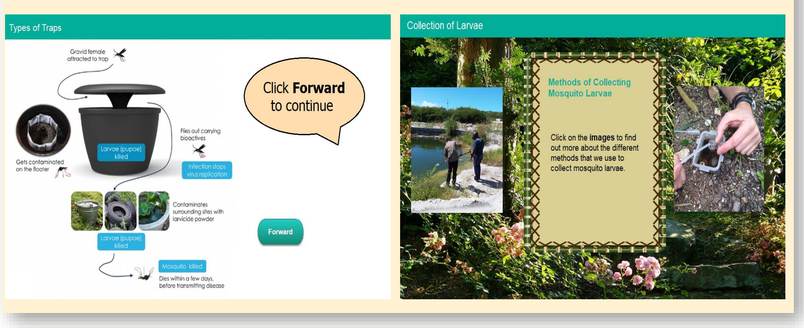
E-LEARNING

Training for specialist vector control officers (VCOs) in the Caribbean UKOTs can be challenging given small island communities and expense of attending off-island training courses. VCOs are critical for a country's ability to prepare and respond to risk to public health from mosquito borne disease. Developing VCOs capabilities is therefore essential to ensuring strong entomological skills in larval and adult surveillance, trapping techniques, sample storage, and identification. Establishing these baselines, particularly with newly employed VCOs, but also refreshing skills within the established workforce has been a key aim of UKHSA support to UKOTs. One aspect of UKHSA's collaboration with UKOTs has been the development of an E-Learning package designed for Vector Control Modules.

Module 1: Focus on identification of and differentiation between key vector species such as *Aedes aegypti* and *Aedes albopictus*, including descriptions of their anatomy and ecology



Module 2 and 3: Focus on collection of mosquito samples, with descriptions and explanations of different trap types



Module 4: Introduction to different types of mosquito control, including advantages and disadvantages

CONCLUSION

Small island nations are particularly susceptible to challenges around capacity and capability, and in the Caribbean, strong-working relationships across the region can reduce these challenges. Utilising FCDO funding, the Medical Entomology group aims to continue to support the UKOTs, particularly the Caribbean UKOTs given their heightened risk from mosquito borne disease. Development of medical entomology expertise within each UKOT is critical to ensuring resilience to future threats, including climate change, which is likely to impact distribution and abundance of key vectors, and regional circulation of viruses. Strong capabilities will help to ensure effective horizon scanning and resilience to future VBD threats.

ACKNOWLEDGEMENTS

The Medical Entomology work in the UK Overseas Territories is funded by the Foreign Office and Development Office (FCDO), UK Government. We would like to thank our colleagues in the UKOTs, without which this work could not progress, and whose incredible engagement and support has maximised collaboration opportunities. Thanks to previous MEZE staff involved in this work: Georgia Kirby, Mia White, Morgan Berrell, Sara Gandy.

Affiliations:
[1]Medical Entomology group, UKHSA. [2]Environmental Health Dept., British Virgin Islands. [3]Environmental Health Dept., Montserrat. [4]Environmental Health Dept., Anguilla. [5]Environmental Health Dept., the Turks & Caicos Islands..