VectorCatch: A Low-Cost, Locally Manufactured Mosquito Trap

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Introduction

Malaria remains one of the **deadliest diseases** in **sub-Saharan Africa.**

- **94%** of the annual **263 million cases** are found in these regions [1].
- **78%** of malaria deaths are **children under 5** [1].

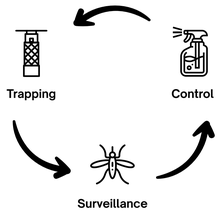

Figure 1: Vector Surveillance Cycle

With effective intervention, these deaths are preventable – but prevention relies heavily on accurate and frequent monitoring of mosquito populations and behaviors to best inform the deployment of specific vector control strategies. A core challenge in surveillance efforts is the lack of scalable and affordable solutions for capturing vector data in real-world conditions.

The current gold-standard – the miniature CDC Light Trap [2] (CDC-LT) – is **expensive** (at $400 USD), **cumbersome**, and **non-modular**.

The absence of reliable data on vector density and species composition hinders targeted intervention, resulting in inefficient use of limited public health resources.


Figure 2: Miniature CDC-LT Deployed in Field

As a result, **80%** of districts in Uganda currently **do not have the means to perform vector surveillance.** 34 districts have an average of 5 CDC-LT's each, and 112 districts have no traps at all. Anecdotally from VCO's, we learned that to reach adequate surveillance capacity, each district needs to have at minimum of **15 traps.**

Objectives

We aim to develop a **low-cost** & **modular** mosquito trap that **matches CDC-LT efficacy** and **improves usability** by:

- Catching the same distribution and species of mosquito as the CDC-LT
- Designing in partnership with in-country stakeholders
- Removing the need for the current 6V battery setup and design the trap for repairability
- Developing an implementation plan with local manufacturers

Results & Findings

Summer 2025

Goals: Travel to Uganda and test first iterations of VectorCatch in-field, collect usability and efficacy feedback, establish connections with stakeholders

The team traveled to Uganda to deploy 3D printed traps in the Malongo & Nawendgy districts. The traps were hung indoors and outdoors alongside CDC-LTs by Vector Control Officers (VCOs) and Village Health Teams (VHTs).

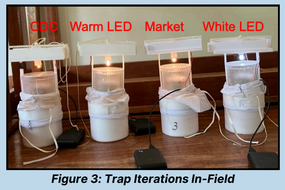

Figure 3: Trap Iterations In-Field

There were versions developed in the field (Figure 3) to assess the performance with different parameters. We also visited the Vector Control Division with trap demos.

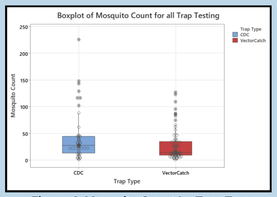

Figure 4: Mosquito Count by Trap Type

Due to the low number of nights for testing (n=10), there were no statistically significant results from the summer. Despite this, we were able to test out the different trap version's performance against each other and the CDC-LT.

The efficacy data collected (Figure 4, Table 1) informed subsequent study plans. Usability questions showed positive feedback for the power bank and overall durability.

Trap	Median	IQR	Minimum	Maximum
CDC	27.5	31.25	0	226
VectorCatch	14	25.75	0	127

Table 1: Descriptive Statistics of Total Mosquito Count for CDC and VC Traps

Fall 2025

Goals: Test specific parameters of the CDC-LT and VectorCatch trap to isolate areas of discrepancy, update on traps across sub-saharan Africa


Figure 5: Traps printed in Uganda

Partners working on the paired device of VectorCam traveled to Kenya and brought traps along with them, and they were recieved positively. n Uganda, VHTs reported testing in the Adjumani and Mayuge districts as well as usage for surveillance in the Wakiso and Nakaseke districts. VCOs also printed traps in Uganda with a 3D printer left in-country (Figure 5).

Back in the U.S., the team focused on testing certain parameters from the summer that potentially caused differences in mosquito count and distribution compared to the CDC-LT. The two main variables are fan flow speed and luminosity, tested with an anemometer and photometer, respectively.

The results (Figure 6) showed comparable flow speed compared to the CDC-LT. These data may inform outcomes from SFS testing.

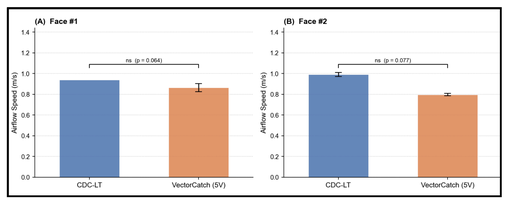

Figure 6: Flow speed testing

Spring 2026

Goals: Finalize test protocol for semi-field site testing and next steps for the following year

Based on suggestions from top entomologists in the field, the next study will be conducted in Zambia at the Macha Research Trust (MRT) study site. This location has a semi-field site that simulates an outdoor environment while still allowing for control of variables such as location, mosquito count, and species distribution.

Test 1	Hut 1	Hut 2	Hut 3
Night 1	CDC-LT	Trap 2	Trap 3
Night 2	Trap 2	Trap 3	CDC-LT
Night 3	Trap 3	CDC-LT	Trap 2

Table 2: Semi-field Site Testing Latin Square

The study will be structured with n=3 study huts in a Latin square format (Figures 7,8) to test different versions of the VectorCatch trap (Table 2).

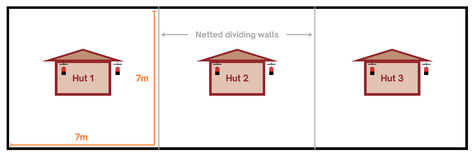

Figure 7: Semi-field Site Testing Hut Setup in Macha Research Trust, Zambia

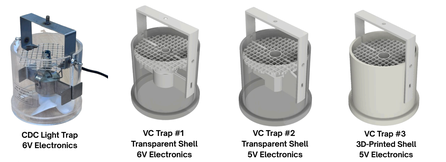

Figure 8: Semi-Field Site Testing Trap Variations

The purpose of the study is to determine which version of the VectorCatch trap is closest to the CDC-LT in efficacy and collect data to support it. This data will be published and presented to stakeholders to verify the validity of the VectorCatch trap.

Conclusions & Future Plans

Local Manufacturing

Based on the main takeaways from each semester, the primary gap in knowledge is the effect of certain parameters of the trap on mosquito count and distribution caught. As such, the SFS study will be critical for informing which iteration of the trap will move forward for conversations with manufacturers.

Lwera Semi Conductors and Electronics is a Ugandan manufacturing firm with capabilities to produce the VectorCatch trap at scale. The team is partnering with Lwera to get production quotes and create a distribution plan.

Usability Testing

In partnership with Uganda's Vector Control Division, we have a formal study planned that will assess ease of use with end-user VCOs using the **System Usability Scale** and **NASA Task Load Index** as well as **open-ended questionnaires.**

An incoming CBID team will continue this project throughout the 2026-2027 year, working to evaluate efficacy of the VectorCatch trap and secure funding to support a national scale-up across Uganda.

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[1] United Nations Children's Fund (UNICEF). (2013). Household survey indicators for malaria control: 2013 edition. https://data.unicef.org/resources/household-survey-indicators-for-malaria-control-2013-edition/
[2] Centers for Disease Control and Prevention. (2024, May 14). Mosquito surveillance traps. https://www.cdc.gov/mosquitoes/php/toolkit/mosquito-surveillance-traps.html