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Snap-shot assessment of adult mosquito (Diptera: Culicidae) densities on the Turks and Caicos Islands, February 2022

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RESEARCH ARTICLE

Abstract

In many of the small island communities of the Caribbean, much of the vector surveillance effort is focussed on house-to-house peri-focal surveys to collect data on larval indices. Adult mosquito trapping is not always routine or affordable and is usually focussed on *ad hoc* biting issues or small-scale investigations. This makes understanding the relative importance and densities of the common urban mosquitoes, such as *Aedes aegypti* and *Culex quinquefasciatus*, problematic. This snap-shot survey in February 2022 using BG-Sentinel traps at 30 different locations across five islands of the Turks and Caicos, aimed to provide the first island-wide assessment of urban mosquito densities. In total, 2,820 adult mosquitoes were collected over 285 trap nights. *Aedes aegypti* was most common on the island of Providenciales, with very low densities recorded on South Caicos, North and Middle Caicos, with *Ae. aegypti* most highly abundant in the main commercial centres. The highest densities of *Cx. quinquefasciatus* were trapped on North Caicos. Small numbers of other species were also collected, including the first record of *Anopheles* in TCI. This established framework of trapping and initial assessment provides a platform for continued monitoring of mosquitoes in TCI to better inform mosquito-borne disease risk assessment and future vector control efforts.

Keywords: *Aedes aegypti, Culex quinquefasciatus*, dengue, surveillance, Zika, chikungunya

1. Introduction

In order to assess the possible risks posed by mosquito-borne disease in the Caribbean there is a pre-requisite need for contemporary data on the range of mosquito species in a territory, as well as an assessment of the relative densities of each species (PAHO, 2019). Data of mosquito-borne disease risk can be generated in a variety of ways, including clinical data on number of cases of arbovirus infection within the human population, or through the generation of data on mosquito densities. The former is only relevant when there is sustained endemic transmission of arboviruses in the human population to generate specific data for disease risk assessment. However, this kind of data is less relevant during the inter-epidemic periods when transmission is low, and it is also subject to recording bias. Therefore, to assess risk, in the periods of no or low transmission, focus is given to recording entomological data, such as larval indices, reports of nuisance biting, or active surveillance of immature and adult mosquitoes (CARPHA, 2017).

The collation of larval indices can be very resource demanding and includes vector control operatives visiting sufficient numbers of households to generate data to calculate house, container and Breteau indices. Such indices have been used to comparatively assess the efficiency of *Aedes aegypti* control, and the risk of mosquito-borne disease (Nathan, 1993). The collection of data for these indices have the advantage of direct contact with homeowners for public awareness campaigns, but generally are not designed to determine mosquito species, nor do they capture the abundance of mosquitoes that might be breeding in non-container habitats, or those in locations beyond reach. Reports of human biting by mosquitoes is not generally recorded in all part of the region, or even globally in any systemic way, although attempts are being made in Europe with an app-based Mosquito Alert system (http://www.mosquitoalert.com/en/). Even then, correct identification is reliant upon expert analysis of photographs, and mostly a specimen is not submitted.

There is usually little substitute for collection of adult and larval mosquitoes through an organised programme of mosquito monitoring, as advocated by PAHO (PAHO, 2019). However, this does require a greater economic cost in the purchase and maintenance of mosquito traps, as well as a degree of expertise in the identification of mosquito samples. Larval sampling is again time consuming, and only reflects the specific aquatic habitats under survey. Whilst it has the advantage of identifying specific larval breeding locations, a modest nationwide survey generally yields insufficient data for a national assessment, and when addressing a variety of different aquatic habitats, is usually difficult to standardise. Therefore, adult trapping, using baited adult mosquito traps is a favoured solution for long term monitoring, where resources permit, or for snap-shot surveys.

This is the premise of this initial survey of mosquitoes in the Turks and Caicos Islands (TCI) during February 2022. This is the first attempt to deploy mosquito traps to the territory and focus was given towards an assessment of the relative abundance of two keys species, *Ae. aegypti* and *Culex quinquefasciatus*. *Aedes aegypti* is a key vector of a number of arboviruses including yellow fever virus, dengue virus (DENV), chikungunya virus (CHIKV) and Zika virus (ZIKV) and has been responsible for notable recent regional epidemics of CHIKV in 2013 (Mowatt and Jackson, 2014), ZIKV in 2015-6 (PAHO, 2022a) and DENV in 2019-2020 (PAHO, 2022b), causing millions of cases.

Understanding the relative densities of these species across the islands is an important step towards focusing vector control efforts and identifying potential risk areas for future disease transmission. Repeated snap shot or longitudinal surveys can, in time, provide data that can be related to control effort, rainfall, or other factors than may influence adult mosquito abundance.

2. Methods

Turks and Caicos Islands

The Turks and Caicos Islands is a United Kingdom Overseas territory in the Lucayan Archipelago (which includes the Bahamas) in the western part of the Atlantic Ocean, consisting of two groups of islands: the Caicos islands and the Turk islands (Figure 1). The islands were formed by oolitic limestone deposits from the Cretaceous period. The islands (21°46’48’N, 71°48’00’W) are located ~160

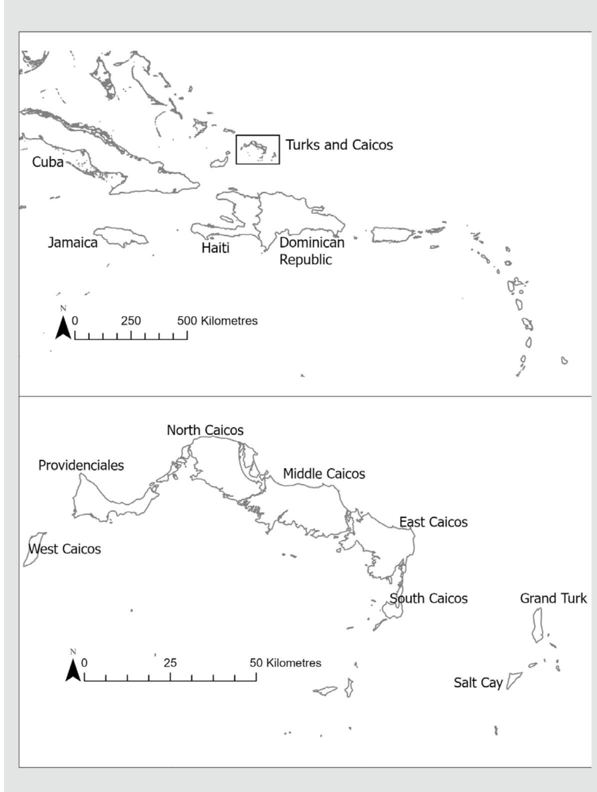

Figure 1. Location of the Turks and Caicos Islands in relation to the rest of the Caribbean.

kilometres north of the island of Hispaniola and ~1000 kilometres south east of Miami, Florida. The total land area of the islands are ~950 km^2 comprised of nine main islands of which the fourth largest, East Caicos, is uninhabited, and the second largest Middle Caicos, has a small population, approximately ~1 person per km^2. According to the 2012 population census, the total TCI population was ~50,000, the majority of which live on Providenciales, with a population density 3.5 times higher than the national average. The second main human population centre is on Grand Turk, with an even greater population density, given its small size. North Caicos and South Caicos have between 1-2,000 inhabitants each. Details of the islands, including population estimates, land area and population density are shown in Table 1.

The islands have a tropical savannah climate and the precipitation level in the Turks and Caicos Islands is among the lowest in the Caribbean, with generally very little rainfall throughout the year. Most showers occur during April through to July, with most rainfall during isolated heavy rain incidents during the June to November hurricane season. The islands typically receive 350 days of sunshine, with a mean daily temperature of 27 °C, usually ranging between 24 and 35 °C, with May to September the warmest months. The night-time temperatures rarely fall below 18 °C (https://www.climatestotravel.com/climate/turks-and-caicos).

Table 1. Physical and human geography properties in the Turks and Caicos Islands. Data estimates for 2019, according to https://en.populationdata.net/countries/turks-and-caicos/

	Population estimate (2019)	Area (km²)	Density (per km²)
Turks & Caicos	39,312	687	57.2
Grand Turk	6,160	18	342.2
Providenciales	30,294	164	184.7
North Caicos	1,443	149	9.7
Middle Caicos	168	144.2	1.2
South Caicos	1,139	21.2	53.7
East Caicos	0	90.6	0.0
West Caicos	10	28	0.4
Salt Cay	108	9	12

Surveillance strategies

In order to conduct a snap-shot survey of mosquitoes on the Turks and Caicos Islands, BG-Sentinel 2® trap (BGS; Biogents AG, Regensburg, Germany) with BG-Lure (Biogents AG), were deployed on five of the inhabited islands, with 19 on the main island of Providenciales, and a further 11 traps on the other islands: three on South Caicos, two on Grand Turk, three on North Caicos and three on Middle Caicos (Figure 1). Out of these 30 traps, 24 were plugged into the mains electrical power outlets whilst sealed lead acid batteries (12V, 17Ah) were used for the remaining six traps. These batteries last for 55 h and were changed every two to three days (Table 2).

Traps were run for up to 13 nights at these 30 locations during 4th – 18th February 2022. Details of locations, trap type and numbers of nights of sampling are detailed in Table 2. Locations were chosen based upon local availability for trapping sites, key locations of known mosquito problem areas, and key locations such as ferry and cruise terminals, hospitals, public and tourism areas. Local compliance with running traps was a key factor, but greater emphasis was given to the more populated areas. This was more challenging on Grand Turk. Although the survey was conducted during the drier period of the year, this better reflects the contribution of container habitat (stored water), rather than increases in mosquito density due to the variability of heavy rainfall events.

3. Results

In total, traps were run for 285 trap nights (ranging from 1 to 13 trap nights per location), trapping 2,820 adult mosquitoes (Table 3, Figure 2). These included 940 *Ae. aegypti* (531 females [♀], 409 males [♂]) and 954 ♀ *Cx. quinquefasciatus*. *Aedes sollicitans* was also trapped on North Caicos and *Aedes bahamensis* on Middle and South Caicos. Overall, 9.89 mosquitoes (♂ and ♀) were caught per trap night, with a global abundance per trap night of 2.05 *Ae. aegypti* ♀ and 3.35 *Cx. quinquefasciatus* ♀.

In total, 93.7% of the ♀ *Ae. aegypti* (498/531) were trapped on Providenciales, with very low numbers trapped on the other islands: (11 on North Caicos, 9 on Grand Turk, 9 on South Caicos and 5 on Middle Caicos). Numbers of females per trap night (TN) was highest on Providenciales [2.43/TN (range per trap: 0-11.67/TN)]and other locations were 0.17-0.41/TN: Grand Turk 0.41/TN (0-0.82/TN); South Caicos 0.39/TN (0-1/TN): North Caicos 0.28/TN (0.08-0.62/TN): Middle Caicos 0.17/TN (0-0.44/TN).

The highest densities of *Ae. aegypti* were at four locations on Providenciales, accounting for 66.7% of all individuals (♂ and ♀), and 72% of all females. These included Bight settlement (11.67♀/TN [140♀, 178♂]), Downtown (9.15♀/TN [119♀, 70♂]), Shipyard (4.5♀/TN [35♀, 28♂]) and Heaving down ferry (4.11♀/TN [37♀, 15♂]). On the other islands, there was no particular location with high densities of *Ae. aegypti*, with highest densities of 0.62♀/TN at Kew (North Caicos), 0.44♀/TN at Lorimers (Middle Caicos), the Cruise terminal (0.82♀/TN) and High School (1.0♀/TN) – both on Grand Turk.

For *Cx. quinquefasciatus*, 54% of all trapped ♀ mosquitoes (515/954) were captured on Providenciales. A much larger proportion (in contrast to *Ae. aegypti*) were trapped on North Caicos (323; 33.9%), with modest numbers on South Caicos (90), Middle Caicos (52) and very few (2) on Grand Turk. Numbers of females per trap night was highest on North Caicos [8.29/TN (range per trap: 0.85-22/TN), followed by South Caicos 4.39/TN (0.33-7.43/TN); Providenciales 2.5/TN (0-11.67/TN), Middle Caicos 1.74/TN (0-4/TN) and Grand Turk 1.00/TN (0-1/TN).

The highest densities of *Cx. quinquefasciatus* were at three locations on Providenciales, accounting for 63.5% of all ♀ *Cx. quinquefasciatus*. These included Heaving down

Table 2. Locations of mosquito sampling across the 5 islands of the Turks and Caicos.

Trap #	Trap type	Name of location	Island	Power type	Longitude	Latitude	Trap nights
1	BG	Mr Grouper restaurant	Providenciales	Mains	-72.187	21.788	12
2	BG	Danny Buoys	Providenciales	Mains	-72.181	21.795	12
3	BG	Hope street	Providenciales	Mains	-72.166	21.797	12
4	BG	Leeward palm	Providenciales	Battery	-72.151	21.811	9
5	BG	Heaving Down Rock (ferry)	Providenciales	Mains	-72.140	21.815	9
6	BG	Shore Club	Providenciales	Mains	-72.154	21.796	9
7	BG	Shipyard swamp (police)	Providenciales	Mains	-72.175	21.766	8
8	BG	Cemetery (The bight)	Providenciales	Battery	-72.199	21.785	9
9	BG	Shark bite	Providenciales	Mains	-72.225	21.785	12
10	BG	Discovery bay (swamp)	Providenciales	Battery	-72.233	21.769	9
11	BG	Cooper Jack Bay	Providenciales	Battery	-72.233	21.758	9
12	BG	Hospital	Providenciales	Battery	-72.251	21.779	9
13	BG	Froggies	Providenciales	Mains	-72.286	21.821	12
14	BG	Blue Hills school	Providenciales	Battery	-72.274	21.804	9
15	BG	Airport	Providenciales	Mains	-72.270	21.776	9
16	BG	Stadium	Providenciales	Mains	-72.217	21.774	9
17	BG	South dock (restaurant)	Providenciales	Mains	-72.278	21.743	9
18	BG	Five Cays (fish proc. Plant)	Providenciales	Mains	-72.264	21.755	9
19	BG	Downtown (EH Office)	Providenciales	Mains	-72.257	21.779	13
20	BG	Marjorie Basden High School	South Caicos	Mains	-71.529	21.503	7
21	BG	East Bay Resort	South Caicos	Mains	-71.522	21.491	6
22	BG	Field Study School	South Caicos	Mains	-71.534	21.492	6
23	BG	Cruise centre	Grand Turk	Mains	-71.144	21.427	11
24	BG	Overback (VC office)	Grand Turk	Mains	-71.144	21.473	1
25	BG	Kew Clinic	North Caicos	Mains	-71.994	21.912	13
26	BG	Whitby	North Caicos	Mains	-71.963	21.953	13
27	BG	Conch Bar	Middle Caicos	Mains	-71.798	21.831	13
28	BG	Lorimers (Bambara)	Middle Caicos	Mains	-71.684	21.796	9
29	LT	Bambara Community Centre	Middle Caicos	Mains	-71.724	21.816	4
30	BG	Bottle Creek Clinic	North Caicos	Mains	-71.919	21.883	13

ferry (11.67♀/TN [105♀]), Downtown 10.46♀/TN [136♀] and Shore club 9.56♀/TN [86♀]. Two of these locations were also associated with high densities of *Ae. aegypti*. On Providenciales there was almost parity in the numbers of the two key species. However, the relative species dominance differed between sites. If we consider the ratio of *Culex* to *Aedes*, this varied from 8.6:1 at Shore club, 2.84:1 at Heaving down ferry, 1.7:1 at Shipyard, 1.14:1 in Downtown and 1:7 in Bight settlement. For the other islands, high densities were at Kew on North Caicos (22♀/TN [286♀]) with a ratio of 35:1, Lorimers on Middle Caicos (4♀/TN [36♀]) with a ratio of 9:1. In South Caicos, High school was highest with 7.43♀/TN ([52♀]; 7.4:1) and East bay 6♀/TN ([36♀]; all *Culex*).

4. Discussion

The snap-shot survey described in this paper has provided data on the density of adult mosquitoes across all of the Turks and Caicos Islands. There has been some attempt to survey mosquitoes on Grand Turk previously. Cohen (1978) ran traps in Grand Turk over 4 nights in March 1974, collecting just over 300 mosquitoes. He recorded mostly *Ae. aegypti, Cx. quinquefasciatus and Aedes taeniorhnychus*, with a small number of *Psorophora pygmaea*. According to CARPHA (2017) there are unpublished records also of *Ae. sollicitans, Cx. bahamensis, Deinocerites cancer, Psorophora ciliata* and *Psorophora confinnis*, but no further details on abundance or locations. There have been no records of any *Anopheles* on TCI (Rawlins *et al.*, 2008), and a general perception that TCI is not at risk from malaria. This survey therefore constitutes the first known evidence of a territory wide adult mosquito trapping survey.

Table 3. Numbers of mosquitoes (and numbers per trap night [TN] given in brackets) at all locations across the Turks and Caicos Islands, February 2022.

No.	Site	Island	Trap night	*Aedes aegypti*		*Culex quinquefasciatus*		*Aedes sollicitans*		*Aedes bahamensis*
				♀	♂	♀	♂	♀	♂	♀
1	Mr Grouper restaurant	Providenciales	12	140 (11.67)	178 (14.83)	20 (1.67)	15 (1.25)	0	0	0
2	Danny Buoys	Providenciales	12	14 (1.17)	19 (1.58)	12 (1.0)	38 (3.17)	0	0	0
3	Hope street	Providenciales	12	18 (1.5)	11 (0.92)	34 (2.83)	46 (3.83)	0	0	0
4	Leeward palm	Providenciales	9	21 (2.33)	18 (2.0)	6 (0.67)	4 (0.44)	0	0	0
5	Heaving Down Rock (ferry)	Providenciales	9	37 (4.11)	15 (1.67)	105 (11.67)	3 (0.33)	0	0	0
6	Shore Club	Providenciales	9	10 (1.11)	1 (0.11)	86 (9.56)	0	0	0	0
7	Shipyard swamp (police)	Providenciales	8	36 (4.5)	28 (3.5)	21 (2.63)	22 (2.75)	0	0	0
8	Cemetery (The bight)	Providenciales	9	19 (2.11)	31 (3.44)	11 (1.22)	33 (3.67)	0	0	0
9	Shark bite	Providenciales	12	0	0	1 (0.08)	0	0	0	0
10	Discovery bay (swamp)	Providenciales	9	0	0	0	1 (0.11)	0	0	0
11	Cooper Jack bay	Providenciales	9	0	0	0	1 (0.11)	0	0	0
12	Hospital	Providenciales	9	0	0	0	0	0	0	0
13	Froggies	Providenciales	12	28 (2.33)	7 (0.58)	8 (0.67)	4 (0.33)	0	0	0
14	Blue hills school	Providenciales	9	9 (1.00)	5 (0.56)	21 (2.33)	25 (2.78)	0	0	0
15	Airport	Providenciales	9	16 (1.78)	4 (0.44)	7 (0.78)	10 (1.11)	0	0	0
16	Stadium	Providenciales	9	11 (1.22)	3 (0.33)	17 (1.89)	8 (0.89)	0	0	0
17	South dock	Providenciales	9	15 (1.67)	9 (1.0)	2 (0.22)	0	0	0	0
18	Five Cays	Providenciales	9	5 (0.56)	5 (0.56)	0	0	0	0	0
19	Downtown (EH Office)	Providenciales	13	119 (9.15)	70 (5.38)	136 (10.46)	136 (10.46)	0	0	0
20	Marjorie Basden School	South Caicos	7	7 (1.0)	0	52 (7.43)	15 (2.14)	0	0	0
21	East bay resort	South Caicos	6	0	0	36 (6.0)	12 (2.0)	0	0	1 (0.17)
22	Field Study School	South Caicos	6	1 (0.17)	1 (0.17)	2 (0.33)	1 (0.17)	0	0	0
23	Cruise centre	Grand Turk	11	9 (0.82)	3 (0.27)	0	1 (0.09)	0	0	0
24	Overback (VC office)	Grand Turk	1	0	0	2 (2.0)	1 (1.0)	0	0	0
25	Kew Clinic	North Caicos	13	8 (0.62)	0	286 (22.0)	123 (9.46)	0	0	0
26	Whitby	North Caicos	13	2 (0.15)	0	26 (2.0)	50 (3.85)	0	0	0
27	Conch Bar	Middle Caicos	13	1 (0.08)	1 (0.08)	16 (1.23)	3 (0.23)	0	0	4 (0.31)
28	Lorimers (Bambara)	Middle Caicos	9	4 (0.44)	0	36 (4.0)	54 (6.0)	0	0	0
29	Bambara Community Centre	Middle Caicos	4	0	0	0	0	0	0	0
30	Bottle creek clinic	North Caicos	13	1 (0.08)	0	11 (0.85)	16 (1.23)	8 (0.62)	6 (0.46)	0
	Total		285	531	409	954	622	8	6	5

As with any snap-shot survey, the results only show mosquito abundance at a single time point and will be subject to variation resulting from numerous factors such as weather and seasonality. It also only shows mosquito density at the locations where sampling was conducted. Ideally many more traps in many more locations could be deployed, but all studies are limited by available human and trap resources. It was decided to focus on 30 key locations across the islands and survey over a number of nights to develop some initial data on mean mosquito density that accounted for variations in weather. This approach was chosen over trapping in many more locations only for one or two nights, which would give presence data, but the density data would be less comparable to future repeated snap-shot surveys in the same sentinel locations. However, generating some adult density data at key locations is nevertheless extremely useful for developing understanding of mosquito populations across the islands, informing mosquito control and public health relating to mosquito-borne diseases.

The results show that *Ae. aegypti,* the most important mosquito species in terms of public health, to be of highest abundance on the island of Providenciales. This species also occurs on all other islands, but, at least during this survey, at much lower densities. As a species that utilises artificial habitats associated with human habitation, it is perhaps unsurprising that *Ae. aegypti* is found at highest densities where there is the largest human population. As

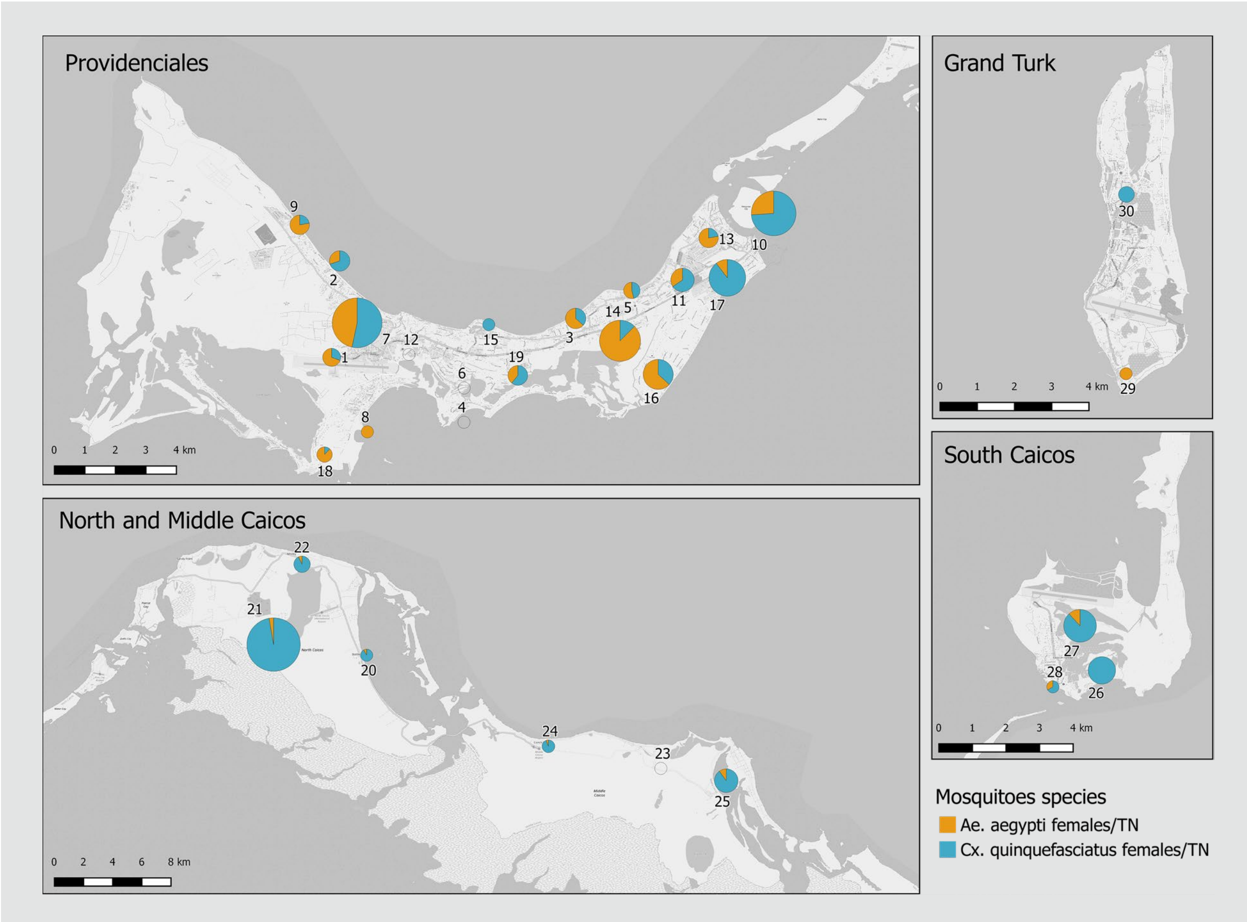

Figure 2. Density of ♀ *Aedes aegypti* (orange) and *Culex quinquefasciatus* (blue) on Turks and Caicos Islands, presented as number of ♀ mosquitoes per trap night (TN). The size of the pie chart represents the average number of ♀ mosquitoes trapped and the proportion of the pie represents the relative densities of the two species.

well as residential homes, Providenciales has a wide range of land-uses, as expected for a densely populated island in the region, including many hotels, restaurants, shops, business, industrial units, and marinas, all of which provide a multitude of breeding sites and hosts for biting.

The two sites with the highest density of *Ae. aegypti* on Providenciales are in areas with high density of restaurants and office buildings, suggesting that, on this island, non-residential areas could be a key habitat for this mosquito, and a focus of local engagement. The reasons for this may be manifold and include high community engagement and consequential reduction of suitable habitats around the home; low use of water collection (e.g. buckets or cisterns) and storage around the home; or less developed engagement of businesses and other non-residential landowners to address mosquito larval habitat. Unfortunately, this survey could not place traps in some residential areas where there was the potential for high rates of trap disturbance, and therefore the results may reflect *Ae. aegypti* abundance at more affluent residential neighbourhoods on Providenciales, rather than be representative of the whole island. Nevertheless, it is clear that non-residential areas support high levels of *Ae. aegypti* abundance and that co-ordination of mosquito control should reflect this. As this study was conducted in the relatively drier month of February (although rainfall events occurred during the study), the data better reflects the contribution of stored water sources to the contributions of breeding urban mosquitoes. It would be interesting to repeat this survey after heavy rainfall events to detect variation in mosquito densities, although the intensity of rainfall events will show a degree of variability and may be less representative of normal mosquito activity. Longitudinal trapping data would enable a measure of this variability.

Rates of *Ae. aegypti* adult captures were low on the other islands. This was expected given that many of the communities on some of the islands (South, Middle and North Caicos) are of low-density housing, which is known to be an influencing factor on *Ae. aegypti* populations. The exception to this is on Grand Turk, where population densities are highest across TCI (~450/km^2), and yet had far fewer *Ae. aegypti* adults recorded compared to

Providenciales, during this study. However, only two traps could be set up on Grand Turk due to logistical reasons and one of these traps only ran for one night. This could have affected the numbers of mosquitoes captured but the density obtained could also accurately reflect a lower population of *Ae. aegypti* on the island. Furthermore, Grand Turk does contrast with Providenciales in having fewer hotels and restaurants which could affect mosquito densities, if they are important in determining densities. Further survey effort though is required on Grand Turk to provide additional data to accurately assess the vector population. Although *Ae. aegypti* was found to be in low numbers on most of the islands in this survey, factors at the local level will be an important influence on numbers as given the availability of suitable container habitat, numbers could increase swiftly.

High densities of *Cx. quinquefasciatus* were found at Kew Creek (North Caicos) and Downtown (Providenciales). Although not a vector of DENV, CHIKV, or ZIKV, the species is important to understand as it can cause a biting nuisance which can be mistaken for *Ae. aegypti.* The species utilises a wide range of aquatic habitats at the larval stage, which explains why it can be found at high densities in both urban and rural sites. Aquatic habitats include containers utilised by *Ae. aegypti,* as well as septic tanks, drains, and naturally occurring habitats such as ditches, ponds and flooded areas.

This survey used adult traps designed to attract host-seeking ♀ *Ae. aegypti* and *Ae. albopictus* mosquitoes, using a kairomone lure, and no other attractant cues such as light, heat or carbon dioxide. Therefore, we expected a low capture rate for other mosquito species, such as *Ae. bahamensis* or *Ae. sollicitans* as both these species are likely to be attracted in larger numbers to an alternative trap or the use of a BG-Sentinel baited with CO_2. The two sites where these species were recorded are typical habitat for marsh mosquitoes in the region. In the case of *Ae. sollicitans,* this species is known to cause a significant biting nuisance on North Caicos. Numbers are likely to vary considerably throughout the year, and as this snap-shot survey was conducted during a dry period, a survey at a different time would likely yield very different results for these species. The biting nuisance experienced on North Caicos may warrant further work using a different trap and perhaps continuously, in order to fully understand the seasonality of marsh mosquitoes on the islands and the impact of seasonal rains, with the aim of designing a data-led mosquito control programme targeting larval habitats.

According to CARPHA (2017), other mosquito species may also be present in the Turks and Caicos Islands. Larval surveys conducted in February 2022 in preparation for this snap-shot survey detected a single larva of *Anopheles albimanus* and a small number of larval *Cx. erraticus* within pond margins at Kew (North Caicos) and a variety of larval stages of *Ae. aegypti, Cx. bahamensis* and *Cx. quinquefasciatus*. The finding of *An. albimanus* is significant, purely as evidence of the presence of *Anopheles*, however further survey work is needed to determine whether these findings constitute a malaria risk. The use of CO_2 with BG-Sentinel 2 traps, or an alternative adult trap system would likely increase the number of species recorded in TCI.

It is recommended that snap-shot surveys in locations like TCI continue, perhaps on a bi-annual or seasonal (four per year) basis, supplemented by some continuous trapping to determine seasonality, as recently shown in other UK Overseas Territories, such as Gibraltar (Medlock *et al.*, 2022). Further trapping now continues on some part of Providenciales, with more than 5,000 adult mosquitoes collected between February and May 2022. Building long-term datasets can empower vector control teams to be able to understand local risk and assess the impacts of their control programmes. Ideally, adult trapping should be complemented with the collection of larval indices, dependent upon available resources. However, larval indices alone do not tend to separate the relative contributions to mosquito biting caused by *Ae. aegypti, Cx. quinquefasciatus* and other species.

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Conflict of interest

The authors declare no conflict of interest.

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