Thinking Outside the Bait Box: A Case Study

Introduction

It is generally not difficult to identify the extent of activity, and the underlying cause, when investigating an established mouse infestation. However, in large and complex buildings it can be difficult to understand the activity patterns and distribution. It can also be very difficult to identify the point at which eradication has been achieved, as it is far more difficult to prove the absence of rodents than it is to demonstrate their presence. *A monitor that demonstrates, with a high degree of certainty, where and when rodents are active, and when eradication has been achieved, is a very powerful tool.*

The objectives of this trial were twofold:

i. To ascertain whether an electronic monitoring system would work in a large and structurally complex building.
ii. To establish whether mouse activity was being under-reported by the pest control contractor.

Assuming the system did work it was anticipated that it would provide information concerning the spatial distribution and activity patterns of mice. The site selected had a known problematic mouse infestation.

Our conclusion was that GreenTrapOnline offers a viable option for monitoring rodent activity in most industrial and commercial premises. Please read on……

GreenTrapOnline (GTO)

This Danish system uses wireless technology to remotely monitor for rodents. A typical GTO installation contains the following components:

- **GTSensor** - wireless device which can be integrated in trapping or baiting stations or used on a standalone bracket. The advantage of the latter is that the rodent does not have to physically enter a bait or trapping station in order to be 'detected'.
- **GTConnect** – the 'brain' of the system, it collects data from the GTSensors and sends it to the main server for processing.
- **GTLink** - a repeater/ router that forwards all received information from the GTSensors to the GTConnect. Used to enhance the range of the wireless network.
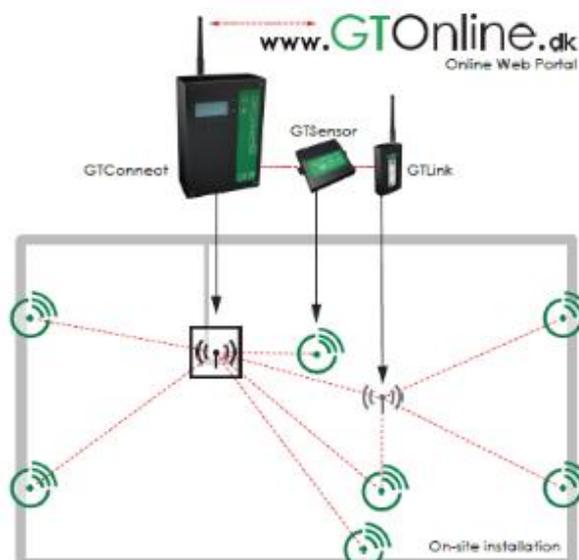
The GTO set-up that we used is several years old and communicates using the Zigbee wireless protocol. This has limitations in buildings with lots of hard materials, so we anticipated that it would be a problem in parts of the test

area. The newer GTO systems use LoRa communication technology, which is much more effective in large, complex structures. We anticipated that if the old technology could be made to work then a newer set-up would be far more effective, and easier to set-up.

Monitoring Trial - Setup

35 sensors were installed on 3rd July 2019. These required the use of 7 GTLinks to ensure an adequate signal was achieved. Mains electrical points were generally present in locations where we needed them, though it is a concern that unplugging, or theft could cause disruption to a permanent installation.

Signal strength did prove to be problematic in some areas, and one of the detectors was not detected by the system for the duration of the trial. Other sensors went 'off-line' occasionally, for short periods of time.

Detectors were mounted on a length of upturned guttering. This means of presentation was chosen because it meant that mice did not have to physically enter a bait-box of any description, something we know they can sometimes be reluctant to do. Where guttering couldn't be used, as it wouldn't fit, the detectors were mounted on brackets. Images of the system components in situ are shown below.

GTConnect - Control box

GTLink – signal repeater

GT sensor mounted on upturned gutter

GT sensor mounted on bracket

Our past experience of using GTO means we know the system to be robust in terms of not registering false positives or negatives. However, to confirm that mice have genuinely been present where activations are received we placed a piece of chocolate at each location. If this had gone when we removed the sensor then we could reasonably assume that mice had been present, and vice versa.
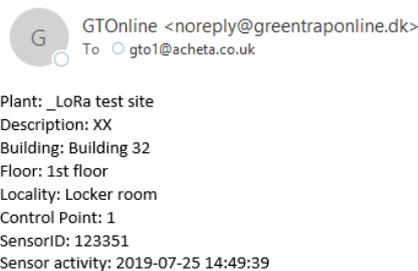
The system was removed on 25th July.

An example listing of locations (as shown on the GTO web-portal) is shown below.

Device	CP	Building	Floor	Locality	Control Point Type	Batt.	SignalStrength	LastSeen
⊙	1	Building 32	1st floor	Locker room	GTO Sensor 3.0	▮	▌▌▌▌▌	2019-07-30 11:04:40
⊙	2	Building 32	1st floor	Canteen	GTO Sensor 3.0	▮	▌▌▌▌▌	2019-07-25 15:18:22
⊙	3	Building 32		Warehouse	GTO Sensor 3.0	▮	▌▌▌░░	2019-07-25 15:19:22
⊙	4	Building 32		Warehouse	GTO Sensor 3.0	▮	▌▌▌▌▌	2019-07-30 11:06:10
⊙	5	Building 32		Warehouse	GTO Sensor 3.0	▮	▌▌▌░░	2019-07-30 11:05:10

The following points may be noted:

- Those sensors that are active but haven't recorded an activation are shown green
- Those that have recorded an activation are shown red
- Those that are inactive (either because they are not in use or are out of range) are shown black
- Sensors that are in use display the last recorded time that they were seen by the control box.
- Battery strength and signal strength are also displayed.

When an activation occurs, an email is received which displays the monitor number, location and date and time of activation, as shown below:

GTOnline <noreply@greentraponline.dk>
To ○ gto1@acheta.co.uk

Plant: _LoRa test site
Description: XX
Building: Building 32
Floor: 1st floor
Locality: Locker room
Control Point: 1
SensorID: 123351
Sensor activity: 2019-07-25 14:49:39

Although sensors are set not to trigger for 20-30 seconds after an activation, multiple activations do sometimes occur when a mouse remains in the vicinity of a sensor for several minutes. *For the purposes of our analysis of activation data such multiple triggers are treated as a single incident.*

Results
Activations by monitor

The number of activations recorded between 3rd and 24th July, by monitor number, is shown below:
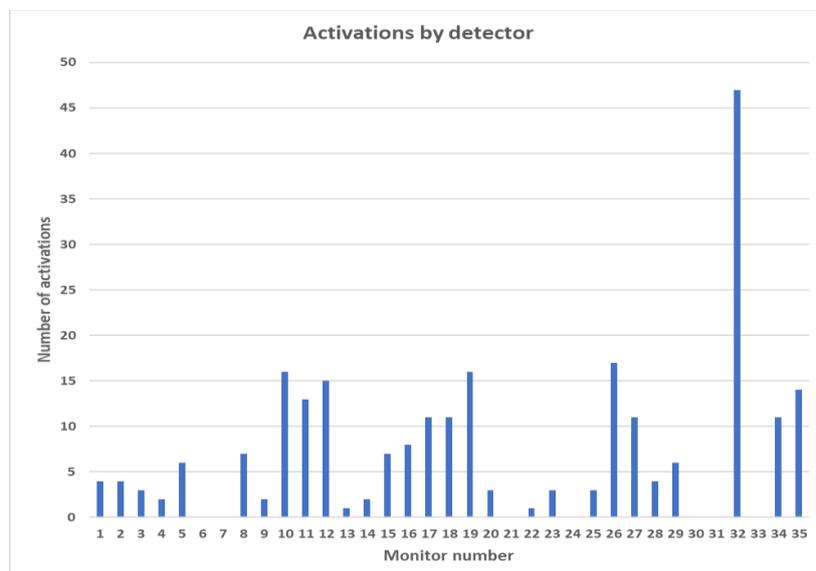
The pattern of activations identified a number of hot-spot areas of activity, some of which had not been identified by the pest control contractor servicing the site.

The pattern of activity by date is shown below. This graph shows a remarkably consistent pattern of activity, with only an occasional spike above or below the average of 12 activations per day.
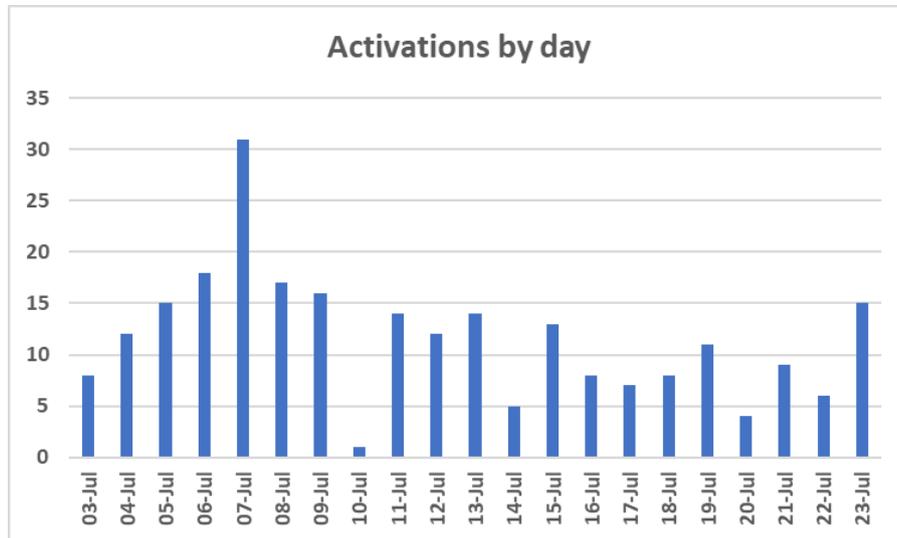
Were the activations genuinely recording mouse activity?

The question will inevitably be asked as to whether the activations recorded were genuine, or were perhaps due to accidental or deliberate activation.

The pattern of activity by time of day is shown below. This graph would strongly suggest that most activations were genuinely recording mouse activity as the pattern is consistent with the expected nocturnal activity of mice; the periods of peak activity were 3 to 4 hours either side of midnight. Sensors recording activity during the peak daytime hours were mostly those located in quiet undisturbed areas.
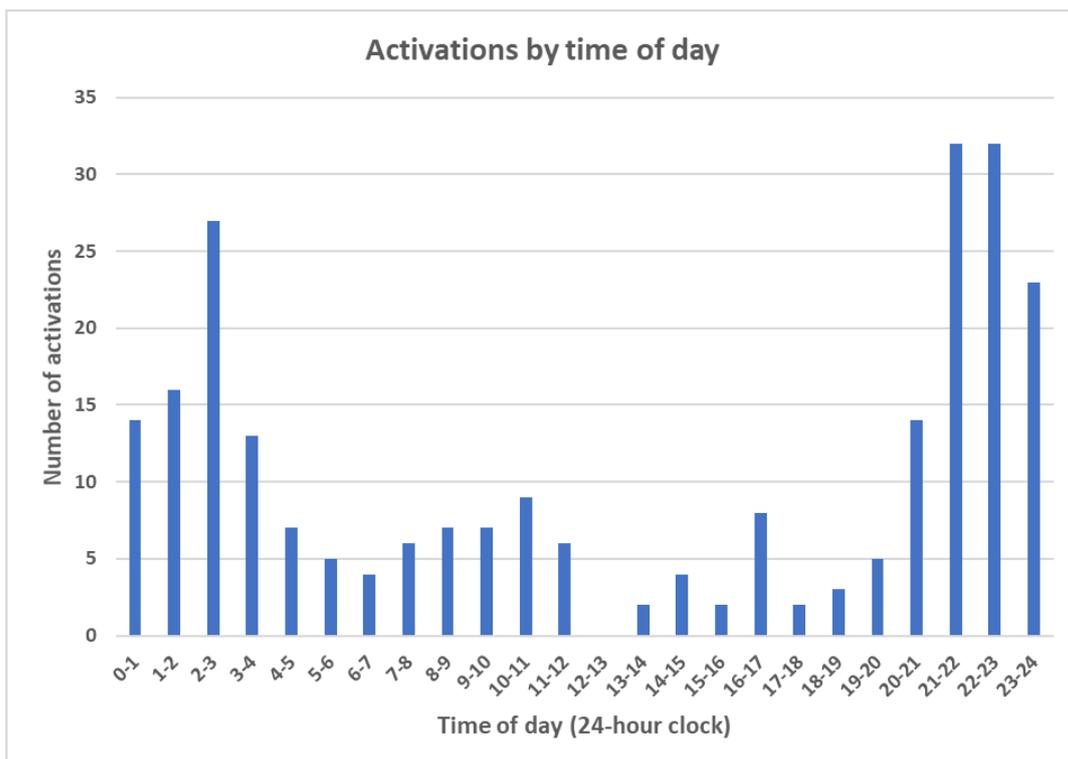
The chocolate placed under each sensor at the start of the trial revealed that in the vast majority of cases where activity was recorded the chocolate had also gone, presumably moved or eaten in situ by mice. In **EVERY** instance where there were no activations recorded, the chocolate remained in position.

There were a few anomalies, where the chocolate was still present despite activation(s) having been recorded. Further investigation, perhaps using tracking dusts or trail cameras would help to determine exactly what is going on in such cases. The unexpected finding that was most difficult to explain concerned activity in an area where there was much competing food, with two detectors recording 13 and 15 activations, yet with the chocolate remaining untouched at both locations. Evidence for mice was certainly seen around the detectors, and it is presumed that mice had ignored the chocolate, perhaps because of the competing food.

How do our findings correlate with the pest control contractor's reports for the same period?

During the period covered by this trial the contractor completed a full routine inspection, on 8th July, and a follow up on 12th. Mouse activity was reported at just one location on the 8th.

At some point during the trial (we can't ascertain the date as we can't find a report covering this) they sited a large number of additional baits and traps in some areas where we had identified significant mouse traffic; as shown below for example. In several of the locations where activity was reported by GTO, there was also evidence of mouse activity as evidenced by droppings or gnawed polystyrene. We found no evidence for mouse activity, by bait take or trap captures, at these locations where the contractor had deployed additional monitors. Indeed, none of the permanent or temporary baits or traps that we inspected during the uplift of our equipment showed any evidence for mouse activity.

Spatial distribution of mouse activity

Shown below is a contour map of the activity recorded.
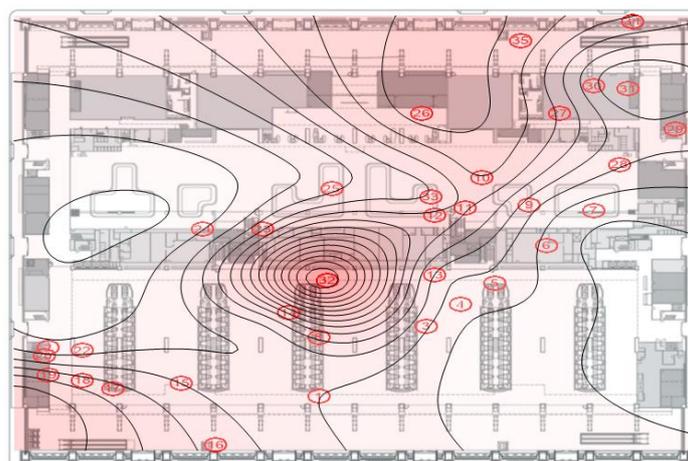
We find these maps to be extremely useful in condensing large amounts of monitoring data to a single picture. In this instance the map is dominated by the undoubted hotspot of activity around monitor 32. It is also, to a degree, compromised by the fact that we were unable to monitor some areas because of signal strength issues.

The upgraded GTO system

On the day we removed the trial equipment we also tested the upgraded GTO system, which communicates using the LoRa (long range) IP protocol, rather than the short range Zigbee protocol used by the trial equipment. The Zigbee system has a maximum range of about 15-20 metres before booster routers are needed, and this range is severely compromised by concrete and metal.

The new system offered good communication with detectors located over at least a 150 metre horizontal radius of the control box. *Our conclusion is that GreenTrapOnline offers a viable option for monitoring most industrial and commercial premises.*