Rodent monitoring: thinking outside the bait box

In the October 2019 edition of SOFHT Focus, **John Simmons** reviewed the non-toxic options for monitoring rodent activity and introduced the concept of remote monitoring. In this second article, he describes a case study of remote monitoring.

The holy-grail of rodent monitoring is detection of movement alone. Such systems are now available with one – GreenTrapOnline (GTO) – featured in this article. Electronic monitoring systems are appearing almost by the month, so this article shouldn't be seen as a specific endorsement of GTO, just our experience of using it.

What must be said, though, is that most of the alternative systems are trap-based; the rodent has to physically enter a housing, such as a bait station or tunnel, and be trapped on a break-back trap, in order for the alert to be raised. We know that behavioural resistance amongst house mice can result in reluctance to enter such devices, so if a system relies on the rodent doing something it might be reluctant to do, then is that system truly a significant advance over conventional baits and traps? In my view, no.

The GTO trial

The site selected for the GTO trial had a long-standing house mouse infestation. The objectives of the trial were two-fold: to assess the technology in a large and structurally complex building; and to establish whether mouse activity was being under-reported.

GTO uses wireless technology (figure 1). Our set-up was several years old and employed the Zigbee communications

Fig 1: The GTO wireless set-up

protocol. The installation comprised: GTConnect, the 'brain' of the system, which 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 and is used to enhance the range of the wireless network; and GTSensor, a wireless passive infrared (PIR) sensor that can be integrated in trapping or baiting stations or used on a standalone bracket.

The trial set-up involved the installation of 35 sensors and ran for three weeks. Zigbee has range limitations, so we anticipated that it would be a problem to install in parts of the site. Seven GTLinks were needed but still signal strength proved challenging in some areas, and one of the sensors was not

Fig 2: GT sensor mounted on upturned gutter

Fig 3: GT sensor mounted on bracket

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 (figure 2). This presentation method was chosen because mice would not have to physically enter a bait-box. Where guttering couldn't be used the detectors were mounted on brackets (figure 3).

Past experience meant we knew the system to be robust in not registering

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

Fig 4: GTO reporting interface

false positives or negatives. However, to confirm that mice were present where activations were received, we placed 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 reporting interface is shown in figure 4. Sensors that haven't recorded an activation are shown green; those that have recorded an activation are red; those that are inactive (either because they are not in use or are out of range) are black; meanwhile sensors display the last recorded time that they were seen by the control box; and battery strength and signal strength are also displayed.

An activation triggers an email displaying the monitor number, location and date and time of activation.

Sensors are set to remain inactive 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 were treated as a single incident.

Activations

The number of activations recorded by monitor number is shown in figure 5. A number of hot-spots were identified, some of which had not been identified by either the pest control contractor servicing the site, or ourselves. The pattern of activity by date shows a remarkably consistent pattern of activity, with only an occasional spike above or below the average of 12 activations per day, as shown in figure 6.

So, were the activations genuine? The pattern of activity by time of day is shown in figure 7. This graph 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 that was placed under each sensor at the start of the trial had disappeared at most locations where activity was recorded, and in every instance where there were no activations recorded the chocolate remained in place. Conclusion: the results were verifiable.

Contractor reporting

During the trial period a full routine inspection by the pest control contractor highlighted mouse activity at just one location. The contractor located a large number of additional baits and traps at several locations where we had identified significant mouse traffic. In several of these locations there were droppings or other evidence.

We found no bait take or trap capture at those locations where the contractor had deployed additional monitors. Indeed, none of the permanent or temporary baits or traps that we inspected during the trial showed evidence for mouse activity.

Probably unsurprisingly, the contractor did question the validity of the activations. However, absence of the chocolate buttons where activity had been detected helped to verify that detections were not false.

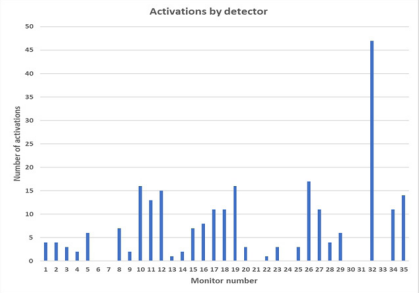

Fig 5: Number of activations by monitor

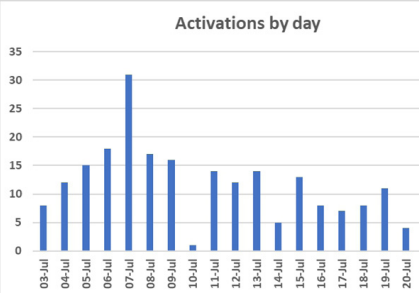

Fig 6: Number of activations by day

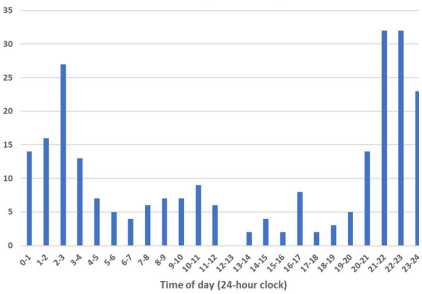

Fig 7: Number of activations by time of day

It would have been good to have a remotely activated camera at every monitoring point, but this was not practical. However, on a subsequent installation we did use a camera to prove that the GTO detector was so sensitive that it took only a few seconds of mouse movement to register. **Click here** to view the video and observe the three flashes

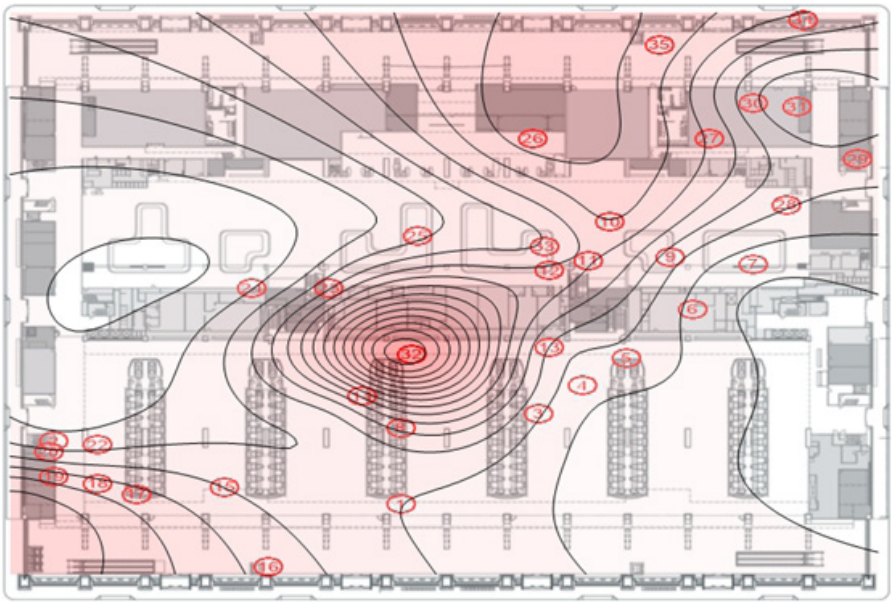

Fig 8: Contour map of mouse activity

on the GTO detector at the 13 second mark.

Figure 8 shows a contour, or heat map, which is extremely useful in condensing monitoring data to a single picture. Our activation data resulted in a map dominated by the undoubted hotspot of activity around monitor 32, though also compromised to a degree by our inability to monitor some areas because of signal strength issues.

The latest version of GTO, and indeed many of the alternative remote systems that are available, communicate using the LoRa (long range) protocol. Zigbee has a maximum range of about 15-20 metres before booster routers are needed. Our recent trial with a LoRa system indicated that good communication was possible over at least a 150m horizontal radius of the control box, even with significant concrete and steel structures in the way. So, in conclusion, the LoRa-based GTO system offers a viable option for monitoring most industrial and commercial premises.

The future

An experienced pest manager should be able to identify the extent of activity and underlying cause when investigating most established mouse infestations. However, large, complex buildings do present challenges to understanding activity patterns and distribution.

The critically important point when eradication has been achieved is also difficult to determine; proving absence is much more challenging than demonstrating presence. A monitor that reliably demonstrates where and when rodents are active, and when eradication has been achieved, is a powerful tool.

Might motion detectors mean that permanently located baits and traps become redundant, to be introduced only when rodent presence is known? As well as being environmentally friendly, this approach will reduce the risk of rodenticide resistance and should enhance control efficacy; a newly introduced device is much more likely to achieve its desired objective than one that has been in place for a prolonged period.

Might, therefore, the conventional permanently sited network of baits and traps be obsolete, replaced by technology more appropriate to the 21st century?

Removing such devices would be a brave move and would certainly require a fundamental change in the mindset of those purchasing pest control services, those whose audits encompass pest control, and the pest control industry itself. However, it is inevitable that the conventional contract, built around attendance to inspect devices, will change. Future pest management inspections should be focused on what they should always have been focused on: looking, not simply checking and servicing devices.

What about rats?

We have focused primarily on house mice in this article as they are by far the most important rodent pest in the food industry. Rats generally present a problem outdoors, and when encountered indoors it is usually because they are coming inside to feed, moving back outside afterwards.

A remote monitoring programme for rats would primarily be focused outdoors. Given that most sites will already have a network of external bait stations it makes sense to use these, even though we know that rats are by nature neophobic (wary of new objects) and can be reluctant to enter bait stations. Determining whether an activation has been caused by a rat or a non-target rodent is likely to be problematic. Perhaps the coming years will see further development, potentially with the widespread introduction of micro-camera technology to help visually identify and verify what is being detected on your premises.

About the author

Dr John Simmons has spent 30 years in the pest control industry. In 2001, he established Acheta, a consultancy specialising in all aspects of pest management, with training and independent inspection and auditing the principal services. Acheta was acquired by Kiwa Ltd, a specialist in testing, inspection, certification, consultancy and training services, in August of 2019 and John continues to run the company.