PROJECT JANSZOON

Together restoring the Abel Tasman

Using A24 traps to keep rat numbers low – for good

Our objective was to find an alternative toxin-free method to reduce rat numbers in areas of the Abel Tasman National Park with high visitor numbers. A total of 203 Goodnature A24 traps were installed to test if rat numbers can constantly be kept low. Over three and a half years, rat tracking rates showed a mean of 6.1 %, or 3.9 % excluding mast year peaks, compared to 90 % in the non-treatment area. The results show that A24 traps are a powerful tool to effectively reduce rats in the long term.

Background

Rats are admirable survivors. They proliferate quickly, eat almost anything, are good climbers and swimmers, and they are smart. Rats are food generalists, their diet consists of insects and other invertebrates, seeds, fruits, leaves, but also bird´s eggs, chicks, and even nesting females of small bird species. As well as predating on native species rats compete for food resources. They probably also influence the survival and dispersal of many plant species. Their negative impact on New Zealand's ecosystem is therefore manifold and has far reaching effects. Three rat species were introduced to the country: the Pacific rat or *kiore* arrived with the first Maori, and later on Norway and ship rats travelled as stowaways on ships from Europe – for the first time on Captain James Cook's ship *Endeavour*. The most common rat species in the Abel Tasman National Park is the ship rat (also known as black rat, Rattus rattus).

Due to their incredible fecundity rats are difficult to control: one pair of rats can have several thousand offspring in one year. Thus, they recover much faster from pest control measures than possums or stoats.

While effective rat control can be achieved through aerial 1080 control, there are several residential enclaves in the Park and high visitor numbers along the coast, and in these areas a non-toxic ground based approach is more appropriate.

Home ranges of rats are small, and so traps or bait stations have to be deployed in very dense networks. Manually set traps are therefore too labour-intensive to be an economic solution, especially on a large landscape scale. They also have a reduced efficiency, as they are no longer functional once they have been set off. The development of self-resetting traps have presented a much more efficient means than single-set traps, and a toxin-free alternative to ground based bait stations. In collaboration with the Abel Tasman Birdsong Trust and the Department of Conservation we tested self-resetting A24 rat traps from Goodnature (fig.1) over six years and present our experiences in sustaining low rat populations in the long term.

The A24 trap network at Pitt Head

Pitt Head is a peninsula that forms the eastern flank of Torrent Bay and covers an area of ca. 120 ha (fig. 2). It was chosen for the A24 trial because the majority of the peninsula is surrounded by sea, reducing reinvasion by rats from the periphery. In 2012, a network of Goodnature A24 traps was deployed. These traps are mounted on tree trunks and once the trigger is set off a gas-fired piston quickly kills the rat, which falls down to the ground and clears the opening of the trap (see fig.1). The CO_2-cylinder contains enough gas to fire at least 24 times.

Figure 1: Dead rats under an A24 trap at Mount Taranaki. There are no weka in this area, hence the low position of the trap.

At Pitt Head, the spacing of traps on a line is 50 m, with 150 m between lines. A total of 203 traps, covering an area of ca. 120 ha, were funded by Project Janszoon. Of the 203 traps, 23 were equipped with a counter in 2014 (fig. 3). Chocolate, cinnamon and peanut butter lures are used and exchanged every six months to keep rats interested in the traps. Traps are checked and maintained monthly by volunteers of the Abel Tasman Birdsong Trust.

Technical and methodological variations

When the project was launched, the traps were new on the market. Initially, some A24 traps leaked gas and had to be serviced by Goodnature. With time, some technical and methodological improvements were made. Traps are now sent away to be serviced when a gas cylinder lasts less than 2 months.

Initially, traps were mounted on trees at 150 mm height. Metal coils were used to avoid weka by-catch. However, dead rats got stuck in the coils and blocked the opening of the traps. To get around this problem, traps were raised up to 700 mm in mid 2014, and instead of the coil a wooden block was attached to the tree 100 mm under the trap. The current best practice is to mount traps at 1300 mm height on straight trees (no wooden blocks are used). The Pitt Head A24 traps were adjusted to this practice early 2017. So far, to our knowledge, there has been no weka by-catch.

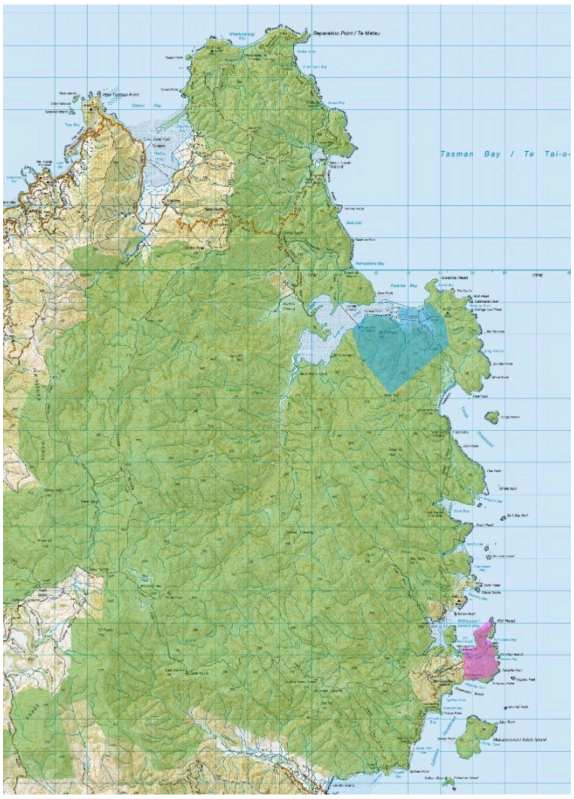

Figure 2: The Abel Tasman National park (green) and treatment areas mentioned in this article: Awaroa non-treatment (blue) and Pitt Head A24 trap area (pink).

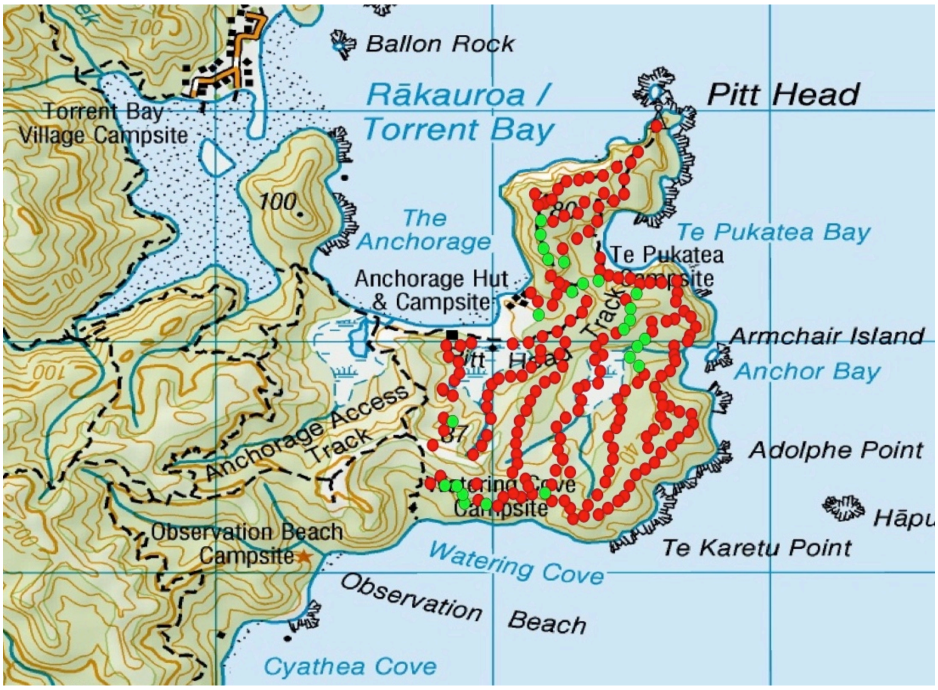

Figure 3: Map of the Pitt Head peninsula near Anchorage. Each A24 trap is represented by a dot. Traps that were fitted with a counter are shown in green.

Results

The standard measure for rat abundance is the rat tracking index (mean percentage of tracking tunnels that showed rat tracks). Four tracking lines are deployed quarterly (fig.4). Each line has ten tracking tunnels, which are run every three months for one night.

Figure 4: Location of four rat tracking tunnel lines at Pitt Head.

Four years of rat tracking at Pitt Head have shown that A24 traps reduced the rat population to a mean of 6.1 % (tracking indices vary from 0-23 %, see tab. 1 in the appendix). In fact, this value is increased by high rat numbers during the beech mast year in 2014, where tracking rates raised to a maximum of 23 %. Outside of mast seasons, the mean tracking rate is as low as 3.9 % (excluding the two mast-peak measures in Nov. 2014 and Feb. 2015, fig.5). However, having a closer look at where these rat counts occur (fig. 6), it become apparent that all rats were tracked at the rim of the A24 trap network, suggesting that the rat tracking index within the core trap area is actually 0 %.

In comparison, the mean tracking rate for the non-treatment area at Awaroa is 80 % (59-87 %). Both Pitt Head and Awaroa are dominated by recovering manuka/kanuka forests on a granite substrate. Although Awaroa has a few pockets of richer broadleaf vegetation, both areas are representative of typical Abel Tasman coastal habitats.

The results are comparable to findings at Harts Hill in Fiordland (1, 2) and Native Island near Stewart Island (3). In both cases, A24 traps reduced rat indices close to 0 %. This minor difference might be explained by the length of time periods during which measures were taken, different habitats and/or differences in trap line design.

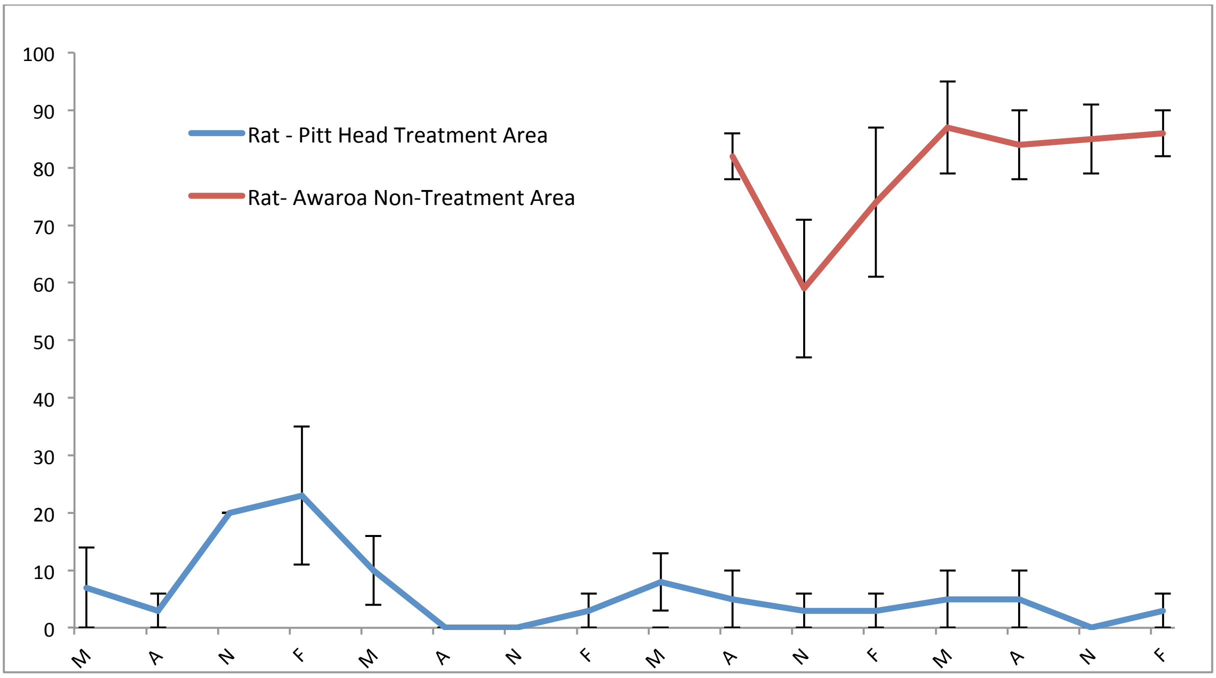

Figure 5: Rat tracking indices (mean percentage of tracked tunnels per line) for the Awaroa non-treatment area (red), and the Pitt Head A24 area (blue). Bars indicate standard errors. Tracking lines at Pitt Head were installed in May 2014, and those at Awaroa were implemented in August 2016. A fourth tunnel line at Pitt Head was added in February 2017, no rats were tracked on this line yet. 2014 was a beech mast year, hence the high tracking index during that summer at Pitt Head. Graph is based on data as shown in table 1 in the appendix.

In summary, the A24 trap network at Pitt Head is a great success, keeping rat numbers approximately 76 percentage points lower than in the non-treatment area at Awaroa. Except for beech mast years, rat number tracking rates are kept at 0 % within the heart of the treatment area, a number that is unrivalled over the entire Park. Figure 5 shows that this rate is constant over several years, though several methodological changes had been made over time. Neither the changes of trap mount height nor the half-yearly change of lures seem to have noticeable impacts on trap efficiency.

Some interesting insights

a) Reinvasion patterns

Rat tracking tunnels are run every three months. Figure 6 shows that rats are mainly tracked along the coast, along the rim of the A24 network. The same pattern is supported by occasional rat by-catch in stoat traps (data not shown). Similar observations were made by the ZIP team at Bottle Rock Peninsula in the Marlborough Sounds (4). Rats seem to take advantage of the coastline for food, presumably mainly at low tide, and to move from one area to the next. In this case, coastlines do not offer any protection from reinvading predators.

Figure 6: A) Map of tracking tunnel lines and location of quarterly rat tracking in the study area at Pitt head. In 2016, three lines were set up, a fourth one was added in early 2017. Additional tunnel lines outside the area of this study were implemented in May 2017. B) Summarised locations of rat tracking in relation to A24 trap positions. Rats are mainly tracked along the periphery, suggesting that reinvasion occurs along the coastline, where no A24 traps are.

b) Correlation between gas usage, trap counters and tracking indices?

In addition to the rat tracking indices, the usage of gas cylinders was also documented. Unfortunately, catch rates cannot be estimated directly as the carcasses are usually scavenged. Therefore, A24 traps can be fitted with additional counters, but that comes at an extra cost. At Pitt Head, 23 out of 203 traps are equipped with counters. It is known that mice set off A24 traps, in which case strike counts overestimate rat kills.

In order to investigate a possible bias of gas use by leaking cylinders, all cylinders that lasted less than 6 months were excluded (see fig. 7). There is no apparent difference in trends, suggesting that technical problems are a minor issue.

Out of curiosity, we wanted to see how well counters corresponded with the usage of gas cylinders and compare these estimates to rat tracking indices (fig. 7). Due to the different nature of these three measures, they cannot be compared directly (quantitatively), but it is interesting to see if they could show corresponding population trends.

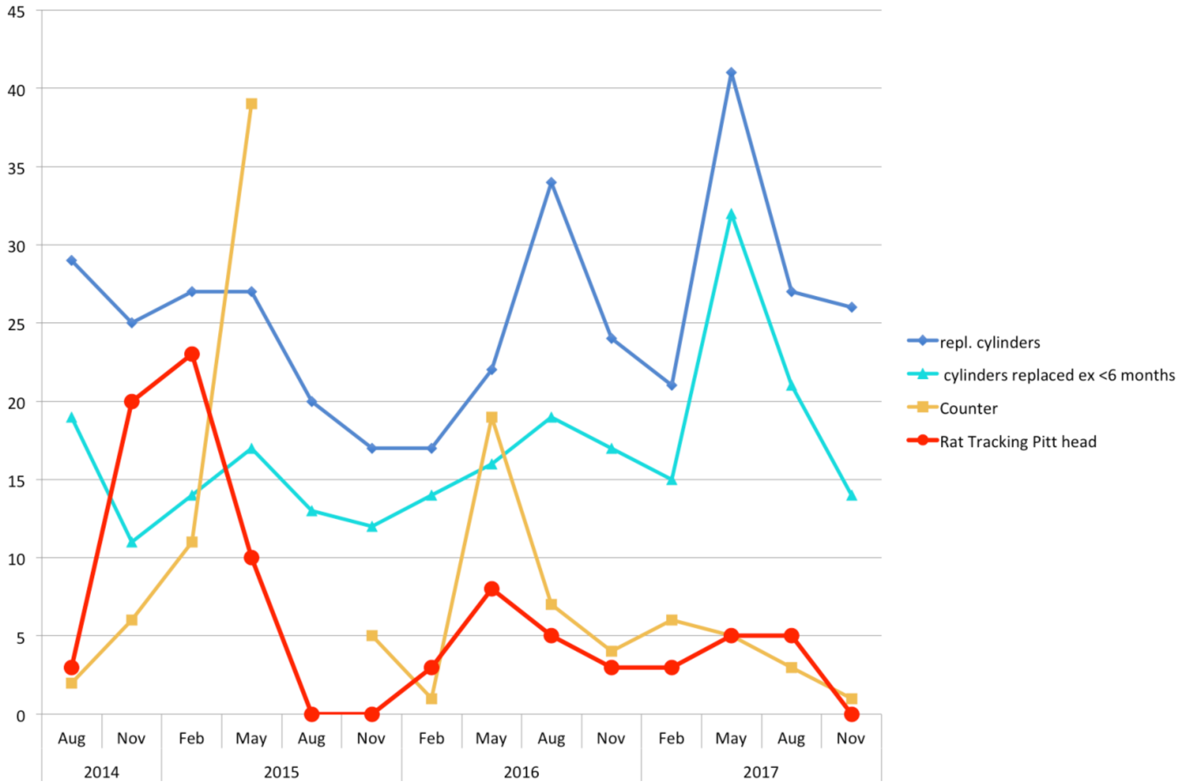

Figure 7: Comparison of number of replaced gas cylinders, trap set-off counts and rat tracking indices as possible indicators of rat population trends (see tab. 2 in the appendix for raw data). To allow illustration of trap counts in parallel with tracking indices, counts were only included for those months where tracking tunnels were run. The number of replaced cylinders is shown in blue. The turquoise line is the number of replaced gas cylinders excluding those that lasted less than 6 months, to avoid a bias by potentially leaking cylinders. No cylinder replacement counts were carried out in August 2015, numbers for this month were interpolated. The orange line shows the number of strikes noted by the 23 traps that were fitted with counters (see fig. 3).
Rat tracking indices are shown in red. A fourth tunnel line was added in February 2017. No rats were tracked on this line, which lowers the over all index compared to the previous months. Note that this graph is meant for comparison of population trends only, it does not allow a quantitative comparison, as different units (total counts vs. % rat tracking) were used.

Tracking tunnels are deployed only once every three months, the graph in figure 7 is therefore representing a rather coarse trend. A graph showing the monthly counts and number of replaced cylinders is shown in figure 8 in the appendix. Figure 7 suggests that gas usage and trap counters mirror rat abundance to some degree, though a more in depth study is necessary to investigate real correlations.

Synopsis

- A24 traps are an effective tool to keep rat numbers constantly low

- Rats are only being detected near reinvasion pathways along the periphery, no rats have been tracked in the core trapping area
- Rats reinvade along coastlines
- There is no evidence that trap mount height or lure type significantly influence target animal catch rates
- Further research is needed to examine if gas usage corresponds with rat densities
- The distribution of traps with counters has to be carefully designed to deliver representative results, and further research is needed to study correlations between trap catch counts and rat abundance and tracking rates, respectively.

Acknowledgements

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Dr. Ruth Bollongino, scientific advisor for Project Janszoon

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References

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2) Department of Conservation (2015) Rat Control (100m x 100m) Harts Hill - Fiordland Project Report. DOC-258259

3) Department of Conservation (2015) NATIVE ISLAND RAT ERADICATION PROJECT REPORT. DOC-2562032

4) ZIP (Zero Invasive predators) Annual Report 2016-17 http://zip.org.nz/media

Appendix

Table 1: Mean rat tracking rate per line (mean % of tunnels where rats were tracked) and the respective standard error (SE) for three areas: Awaroa (non-treatment), Pitt Head (A24 traps) and the aerial area (1080 operations). Data are based on five tunnel lines at Awaroa and three tunnels lines at Pitt Head. In February 2017, a fourth tunnel line was installed.

	Mai 14	Aug 14	Nov 14	Feb 15	Mai 15	Aug 15	Nov 15	Feb 16	Mai 16	Aug 16	Nov 16	Feb 17	Mai 17	Aug 17	Nov 17	Feb 18
Awaroa										82	59	74	87	84	85	86
SE										4	12	13	8	6	6	4
Pitt Head	7	3	20	23	10	0	0	3	8	5	3	3	5	5	0	3
SE	7	3	0	12	6	0	0	3	5	5	3	3	5	5	0	3

Table 2: Number of gas cylinders exchanged and strike counts per month as well as quarterly rat tracking rates at Pitt Head

		Repl. Gas cylinders	Repl. Cylinders ex <6 months	Counter strikes	% Rat tracking
2014	Aug	29	19	2	3
	Sep	30	18	2	–
	Oct	8	5	9	–
	Nov	25	11	6	20
	Dec	39	21	21	–
2015	Jan	26	14	19	–
	Feb	27	14	11	23
	Mar	50	34	16	–
	Apr	29	21	36	–
	May	27	17	39	10
	Jne	29	16	27	–
	Jly	25	17	23	–
	Aug	–	–	–	0
	Sep	16	10	11	–
	Oct	16	11	5	–
	Nov	17	12	5	0
	Dec	15	12	16	–
2016	Jan	17	14	33	–
	Feb	17	14	1	3
	Mar	11	8	0	–
	Apr	21	14	11	–
	May	22	16	19	8
	Jne	24	16	10	–
	Jly	19	12	9	–
	Aug	34	19	7	5
	Sep	11	8	4	–
	Oct	10	5	3	–
	Nov	24	17	4	3
	Dec	26	20	2	–
2017	Jan	23	19	4	–
	Feb	21	15	6	3
	Mar	14	11	7	–
	Apr	20	17	13	–
	May	41	32	5	5
	Jne	28	21	0	–
	Jly	25	21	3	–
	Aug	27	21	3	5
	Sep	18	13	1	–
	Oct	38	15	2	–
	Nov	26	14	1	0
	Dec	24	21	3	–

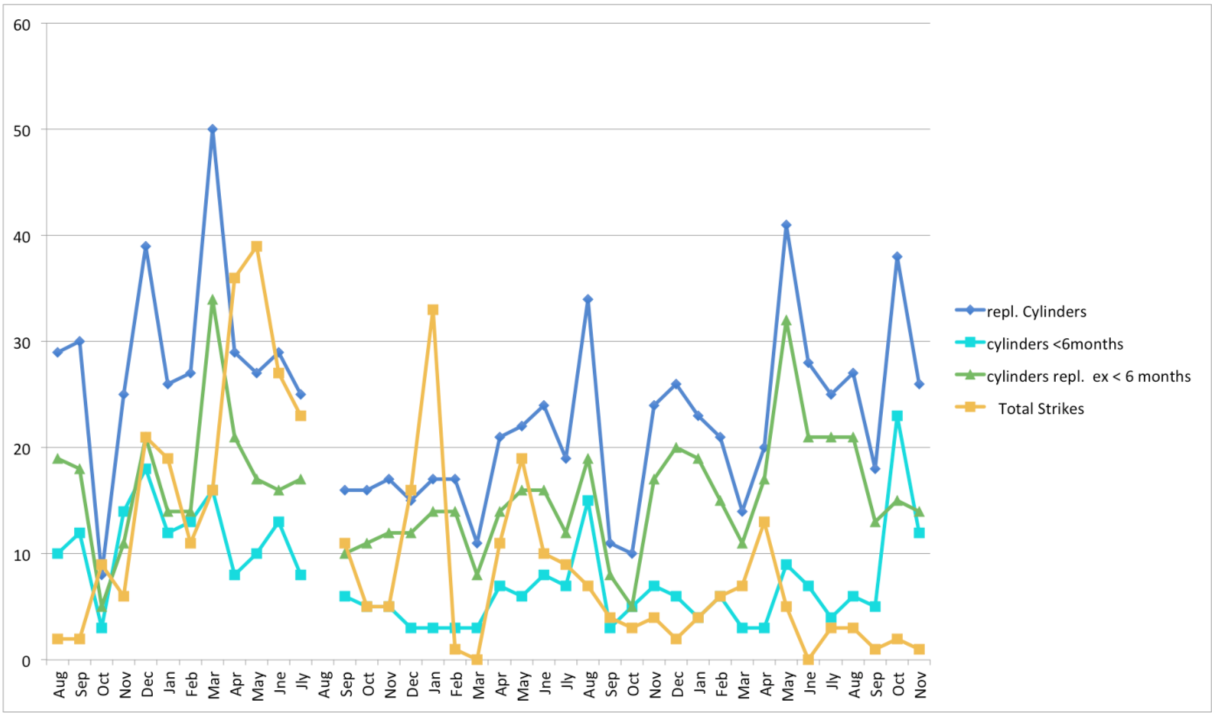

Figure 8: Number of trap strikes (orange, derived from 23 traps with counters), total number of replaced cylinders per month (blue), number of replaced cylinders that lasted less than 6 month (turquoise), and number of replaced cylinders excluding those that lasted t=less than 6 months (green). No data were collected in August 2015.