MANGATUTARA CATCHMENT

DNA SURVEY

PREPARED BY | TRAP AND TRIGGER LTD

EXECUTIVE SUMMARY

A DNA SURVEY WAS CARRIED OUT OVER 13.6KM^2

207 SCAT SAMPLES WERE TAKEN

60 INDIVIDUAL DEER WERE IDENTIFIED IN THE AREA

Raukūmara Pae Maunga (RPM) has the management of ungulates to low densities as one of the key focuses in their operation to restore Te Raukūmara. In September of 2024 RPM partnered with Trap and Trigger (T&T) to undertake a systematic DNA survey of red deer in the Mangatutara catchment to further their understanding of this deer population. This survey together with the data collected in the 2023 survey of the Raukokore will form a baseline. Future surveys will be able to be compared against this data to gauge trends in ungulate numbers over time, in years and decades to come. Individual deer scat samples were taken by T&T and RPM fieldworkers and sent to Eco Gene for DNA analysis.

SURVEY SUMMARY

- A DNA survey was successfully carried out over 13.6km^2 from the 17-19 September
- Seven staff (four RPM and three T&T) took part in the operation
- All staff were trained in DNA survey field work
- 207 scat samples were taken
- 60 individual deer were identified in the surveyed area
- The operation was carried out without any incidents affecting Health & Safety of staff

01 | INTRODUCTION TO DNA SURVEYS

DNA scat survey was the chosen monitoring tool due to its ability to deliver 100% detection rates within the area surveyed. The high rate of detection enables the collection of accurate data with a known relationship to deer density i.e. 60 deer detected means 60 deer using the surveyed area. This is a marked strength of the method as opposed to other deer monitoring techniques (Fecal pellet line, camera traps) which only give a relative estimate of deer densities i.e. 'high' or 'low' density.

DNA analysis also gives additional information on herd makeup i.e. sex ratio, and distribution of individuals across a landscape. DNA analysis was pioneered in Aotearoa on Secretary Island where the detection of every member of a resident deer population was vital to the ongoing eradication effort. Since T&T's involvement in the successful DNA survey on Secretary T&T has been involved in DNA surveys on Ramsay Island (Canada), Russell State Forest and East Harbour Regional Park.

DNA surveys have been well established as a method of census of a total population i.e. an island where the entire area is surveyed.

RPM however, in partnership with T&T, is pioneering the use of DNA surveys as a sample of a population.

The entirety of Te Raukūmara is not being surveyed; instead select areas are being surveyed and the data being used to inform ongoing suppression work.

02 | PROJECT OBJECTIVES

The stated objectives for the DNA survey were to:

1. Determine ungulate densities per square kilometre at a crucial point in the programme.
2. Set data informed management decisions and control targets.
3. Determine control efforts required to reduce deer to desired levels.
4. Use the information to guide choice of control methods and sequencing of these.
5. Test the efficacy of control techniques at known ungulate densities.
6. Enable managers to understand the likely rate of population growth at sample sites.
7. Evaluate the performance of control strategies used at the end of the period (if survey repeated).

FIGURE ONE
DNA Sample Captured

03 | METHODOLOGIES

1

METHODOLOGY

NAVIGATION

The chosen area around Mangatutara/Milky Creek was divided into separate survey lines sidling 150-200m apart using an accurate Geospatial Information System. This distance is calculated to ensure that a line goes through the home range of every deer present allowing 100% detection. These lines were then uploaded onto handheld units for everyone involved ensuring workers are able to accurately follow their assigned line.

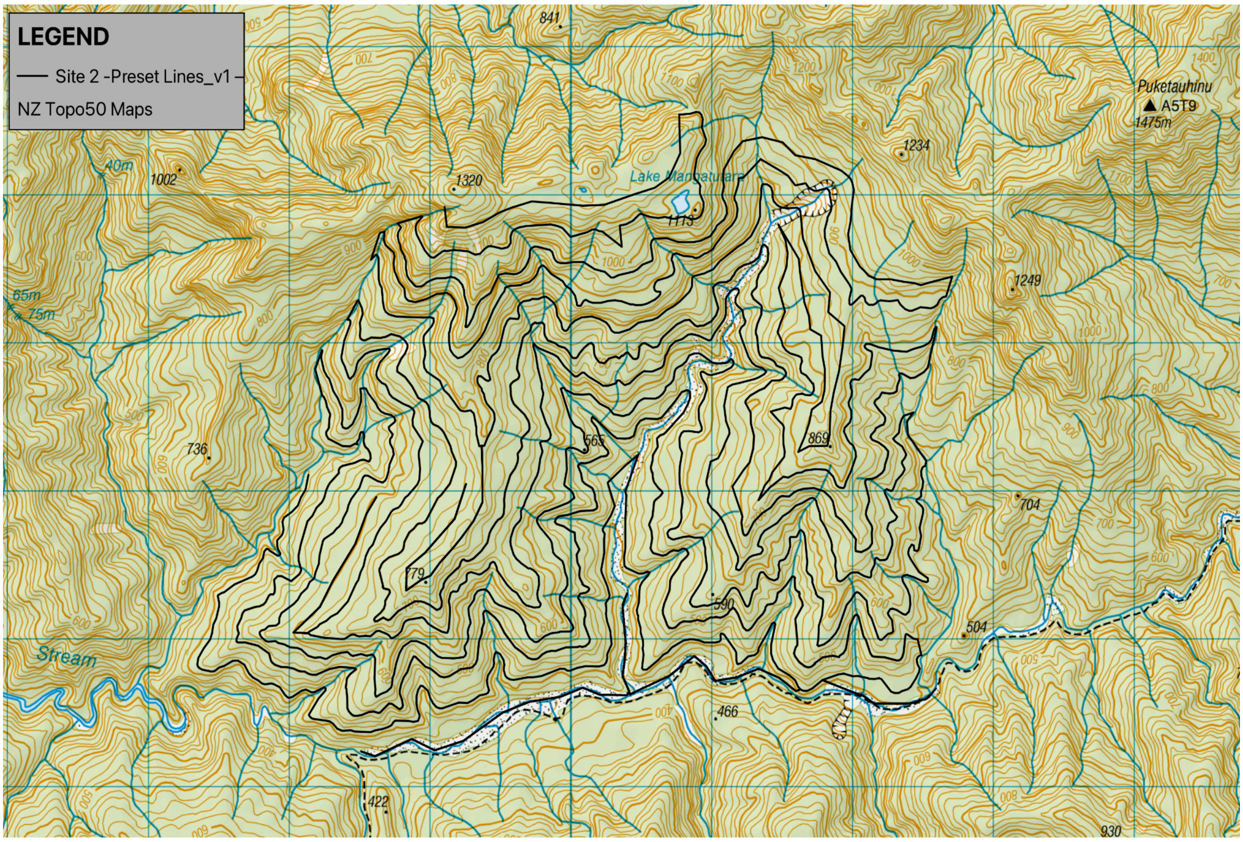
Informed by learnings from the last operation in which having to walk significant distances to the start of lines limited the area able to be surveyed the team employed heli support with Steve from Motu Helicopters dropping workers off up Milky creek on the first day and again on the second day dropping workers off up stream in Mangatutara and up a side creek. This minimised the time spent 'deadwalking' or just walking to get to lines where surveying could begin enabling workers to spend all day completing survey lines and was a huge contributor to the success and speedy completion of the survey.

Also informed by the experience of the 2023 Raukokore survey the highest lines in the survey area were excluded. This was done to limit the exposure of staff to dangerously steep country which both decreases the risk of the operation and reduces the time required by limiting the time spent in areas which have to be traversed extremely slowly and often with significant detours around cliffs, bluffs and slips.

This decision was also informed by the data gathered in the Raukokore which showed low usage of the higher areas of the hills by deer and the known vulnerability of animals in these areas to Thermal assisted detection (TAD) paired with helicopter based hunting. This would leave a gap in the data gathered as a total census of a catchment. However because RPM is using this data as an ongoing survey tool for measuring change in deer numbers over time the value of this data is not decreased by the exclusion of the higher lines as trends in deer numbers will still be able to be accurately measured using data from the lines surveyed.

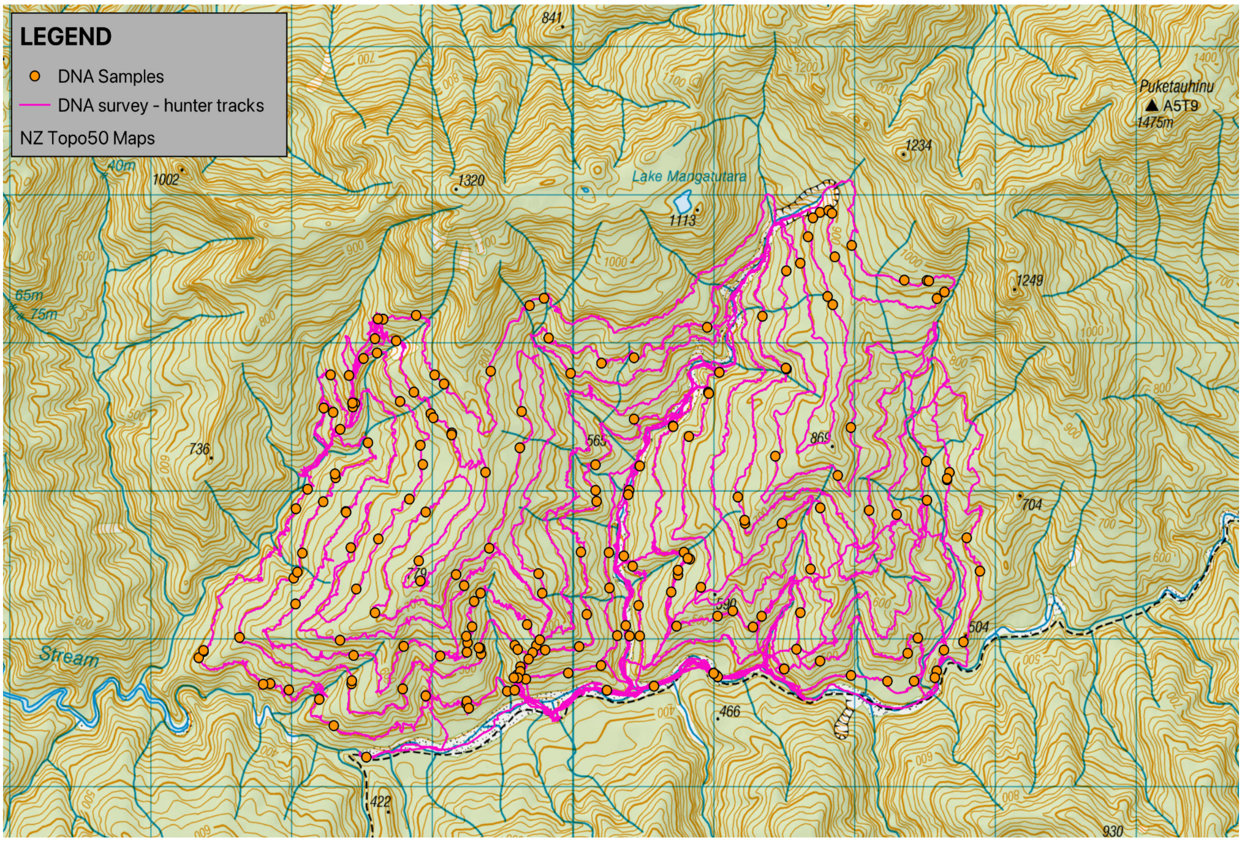
MAP ONE

PRESET SURVEY LINES



MAP TWO

HUNTER TRACKS / SAMPLES COLLECTED



METHODOLOGY

2

SAMPLING

The worker follows their assigned line while scanning for scats. The worker must find scats and assess their freshness. The mucus on the outside of scats is the only part of the scat which contains deer DNA so it is important that the scat is fresh. Exposure to rain or heat/sun decreases the viability of the scat for sampling. Once fresh scat was found, the operator applied gloves and swabbed the 3-4 most sheltered faecal pellets. The head of the swab was then broken off and placed in a preservative solution within a vile. Using a GPS, the location of the sample was then waypointed with the sample number in the waypoint title to connect the geospatial data to the samples taken.

Once the operation was completed the staples were sent to Eco Gene for analysis of the number of individuals and the sex of those individuals.

04 | SUMMARY OF EVENTS

The operation took place between Monday 16 September and Friday 20 September 2024.

16 SEPT	T&T staff run training on scat sampling, data collection and navigation Transect lines are uploaded to handheld GPSs Scat sample kits are put together Gear is discussed and sorted. Health and safety discussed. Food bought.
17 SEPT	Teams gear is flown into Mangatutara hut while 6 workers are dropped in to higher points to start survey lines One worker established camp and sorted gear before completing half day of survey
18 SEPT	Heli picks up workers from the hut first thing and drops them higher up to begin working their way back to camp along survey lines GPS data collected each evening and checked against samples brought in
19 SEPT	Final day of surveying planned to fill in remaining gaps Survey completed in time. Inreach used to make contact and arrange to be flown out in the evening. Debrief carried out and GPS data and samples collected at accommodation in Ōpōtiki.
20 SEPT	Final debrief and teams travel home

05 | RESULTS

Of the 207 samples collected 26 did not provide enough DNA for analysis leaving 181 successful samples

The analysis of the DNA sampled resulted in an approximate 60 individual deer.

As the area surveyed was 13.6 square kilometres this works out to be a density of 4.4 deer per kilometre. Taking multiple samples (3 on average) for every deer found shows overlapping detection meaning we can have a high confidence in our detection rates.

All samples additionally underwent sex testing which identified 9 males and 29 identified females. While not all samples produced a positive sex test this gives an indication as to herd makeup.

06 | DISCUSSION

The data from the DNA survey gives an accurate snapshot of the population density at a point in time. To make this data useful for informing management decisions we need to interpret this data as it relates to three key factors, that is;

1. The relationship between deer density and bush recovery in order to determine a goal density at which RPMs goals for forest health can be met
2. How the deer population surveyed has already been affected by control efforts including ground hunting, aerial hunting and 1080 application
3. The relationship between deer density and reproductive potential, in order to determine future breeding rates and the culling effort required to remove the annual increase and therefore maintain a steady population

These factors can then inform three phases of a management: Goal setting, 'knockdown' and maintenance

In addition, given the possibility of the DNA survey method as a survey to be carried out on a regular basis in the future, we should not only be assessing the data produced so far in terms of deer density but also the less formal data we have produced as to what makes for a successful survey. Using learnings from our two surveys to improve future methodologies could significantly reduce costs and improve the efficiency of future surveys.

07 | DENSITY-IMPACT RELATIONSHIP

The key data in any ungulate control operation which is concerned with bush regeneration is not how many ungulates have been shot but how many are left alive. It is the affect that these remaining deer have on the bush which a control operation has to understand to set goals and understand the impact ungulate control is having on bush regeneration.

CASE STUDY

PUREORA
Nugent et al, 2001

Nugent et al (2001) found in a study in Pureora that deer density has a nonlinear relationship to browse impact. That is to say that Nugent et al (2001) found that even at low densities deer almost entirely stopped the regeneration of highly preferred species such as kāpuka and kotukutuku. However with medium deer densities where deer survive primarily off the leaf fall of a few highly preferred tree species some species such as black maire and tāwheowheo which are less preferred browse had higher rates of regeneration than in the absence of deer browse due to the removal of competing highly preferred species. Those same species which saw an increase in regeneration with medium deer densities however also suffered as deer numbers increased to high densities where leaf fall was insufficient to support the population and deer were forced through lack of food to diet switch to less preferable species.

While it is unlikely that the RPM project will be able to reduce deer densities to the level required to see the regeneration of highly preferred species across as vast an area as te Raukūmara, reducing and maintaining deer densities to a level which allows the recovery of some less preferred species should be an achievable aim for culling operations.

Data is not available for what this density might be in te Raukūmara. This could be a focus for future study. However taking learnings from other parts of the county reductions of deer density to below around 6 deer per km2 in the Kaweka Ranges were found to result in mountain beech Nothofagus cliffortioides regeneration beginning after being browsed out by higher deer densities. (Wildlife Management Associates, 2009). ALthough this data is from a different context and cannot be assumed to translate directly into te Raukūmara it gives an idea of the level at which mountain beech, which is a low preference browse species begins to see regeneration. This could be taken as a maximum number to see some regeneration in the bush.

Another study carried out over four decades in the Murchison mountains gives an idea of what reduction of deer populations to low levels is able to achieve. Tanentzap et al (2009) records recovery of palatable species occurring where deer densities were between 0.6-1.1 deer per km2. Palatable species recovery was still lower than in exclusion plots at this density but this can be taken as an estimate of deer density required to see the recovery of palatable species on a landscape scale.

Using the data collected in the Raukokore and the further DNA survey in the Mangatutara gives RPM a good idea of where deer numbers sit now which allows for goal setting as to the number of animals to be removed per km2. To make best use of density data, further monitoring work to establish the relationship between deer density and bush regeneration in te Raukūmara should be done. This could be done through exclosure plots paired with unfenced control plots and wider understory monitoring. Picking a specific palatable plant species and monitoring its regeneration could also be an option for establishing an indication of density-impact relationships. However, without further monitoring work in te Raukūmara which could take years to produce usable data, goals set from available data gathered in previous studies in other parts of the country can guide the ungulate control program.

FIGURE TWO
DNA Survey Team

Using the studies in the Kaweka and the Murchison mountains as a guideline for required densities, setting goals to see a minimum reduction to 6 deer km2 and an ideal reduction of deer to <1 deer km2 can be set. Using the data gathered in the Raukokore and the Mangatutara which showed deer density at 4.5km2 and 4.4km2 respectively a minimum reduction to see limited regeneration could be assumed to have been met already. However a further 3.5 or more deer per km2 should be removed to bring deer populations to a level where more widespread regeneration is to be seen. This goal of removing 3.5 deer per km2 can be applied wherever RPM is carrying out control and effort can be adjusted to try and meet this goal.

08 | EFFECTS OF PREVIOUS CONTROL

The deer densities seen in the Mangatutara are the deer which remain after efforts already carried out by RPM on the area. Ground hunting and aerial hunting have been carried out and RPM may wish to compare their kills from the survey area with the numbers detected to gauge a very rough idea of the effectiveness of their effort so far.

RPM has also carried out pest control targeting possums and rats using aerial application of 1080 cereal pellets throughout the Raukūmara including in the Mangatutara which had 1080 applied 11 months prior to the DNA survey. While 1080 is primarily targeted at possums and rats, by-kill of other pests such as mice and stoats is an additional benefit of 1080 (Elliott & Kemp 2016). Deer can also experience high mortality as a result of by-kill by 1080 (Morriss et al 2020). Morris et al. (2020) reviewed the impact on deer across 26 1080 operations and found that while the effects of 1080 on deer populations varies significantly, deer are most likely to experience high mortality in areas with a high rate of application (defined as 2.0 - 3.1 kg ha−1) and in areas without a history of toxin application. As the Mangatutara has never had 1080 applied before and the 1080 application previous to the survey was a very high concentration at 4 kg ha−1 (Department of Conservation, 2023) it is quite likely that the deer population has been significantly reduced in the survey area immediately prior to the survey being carried out.

While we cannot be sure of the mortality rate of deer in the Raukokore due to the 1080 drop it is likely that the drop constituted somewhat of a 'knockdown', a one off event in which a large portion of the population was killed. Carrying out the DNA survey after both the 1080 application and ungulate specific control work makes it hard to accurately distinguish the effects of one from another but gives a good base to compare a post knockdown population with the target density. It also gives a valuable baseline for comparing against future DNA surveys, giving a more accurate measure of the effectiveness of culling efforts between surveys.

09 | RELATIONSHIP BETWEEN DEER DENSITY AND DEER RECRUITMENT

The recruitment rate in wild deer is heavily density dependent (Kapota 2018). That means that as deer populations near the carry capacity of their habitat the recruitment rate decreases. In effect, hungry deer who have to compete for food don't reproduce as fast. However as a deer population decreases the availability of good food available to each individual increases and the rate of recruitment correspondingly increases. This is effectively a compensatory mechanism whereby the more the population is decreased, the more the population increases annually. In te Raukūmara where there has been a population which has faced little pressure from hunters and has never been exposed to 1080 we could assume that the population was at or close to carrying capacity, that is, to the highest densities that could be supported. This means that in response to the knockdown due to 1080 and the subsequent availability of food the population is likely to see increased rates of recruitment.

To maintain the gains already made in decreasing deer to 4.5 per km2 in the Raukokore and 4.4 per km2 in the Mangatutara the annual increase of the population must be removed. Further decrease of the population to goal densities of <1 per km2 requires the removal of 3.5 deer per km2 on top of the annual increase. Hone et al (2010) estimates that the annual harvest required to stop population growth for deer lies from 30-46% of the population. In our survey area 30% of the 60 deer would give 20 deer as the minimum estimated deer required to be removed per year to see the deer population not increase. With 4.4 deer per km2 a 30-46% harvest would mean 1.5-2.1 deer km2 per annum to maintain that density. 1.3-2.0 deer km2 per annum is the estimated harvest required not to decrease the population but simply to stop its growth.

This number, as a percentage of the population, would decrease correspondingly as the population decreases. I.e. if the deer population had been reduced to the goal density of 1 deer km2 an annual harvest of 0.3-0.5 deer km2 would be required to maintain that density.

10 | OPPORTUNITIES FOR FUTURE SURVEYS

As experience in carrying out DNA surveys in the challenging environment of te Raukūmara is gained opportunities for further development of DNA survey methodologies both specific to te Raukūmara and within the wider context of ungulate management in Aotearoa are presented.

The survey in the Mangatutara benefited greatly from changes in methodology developed out of the experience of the first Raukokore survey. These changes are discussed above under methodologies but can be summarised as the use of helicopter support in the form of morning drop offs and the exclusion of higher, less suitable terrain from the survey area.

Further development could include an analysis of detection rates to determine the maximum distance between survey lines which would still produce acceptable results. As multiple samples have been taken for each individual detected there may be a possibility of increasing the distance between lines while maintaining high detection rates. This would have the benefit of reducing the time and financial cost of the surveys contributing to their sustainability.

Other opportunities may include working with other organisations carrying out similar surveys who could be able to contribute to a co-development of DNA surveys as a tool for population sampling. Taking the pioneering work RPM is doing and working with other organisations such as DOC who have used similar methods in the Murchison Mountains Te Puhi-a-noa.

11 | CONCLUSION

The DNA survey of the Mangatutara was the second of two DNA surveys to be carried out in te Raukūmara to gather baseline data on the deer density throughout the range. The data gathered showing deer densities of 4.4 deer per km2 gives a solid basis for goal setting in the wider ungulate management strategy of the RPM project. However the real value of this data lies in the possibility for comparison against data from future surveys. This would allow RPM to measure the effect of their culling efforts on deer densities and potentially, if paired with a wider vegetation monitoring program would allow for RPM to measure the effect the remaining deer are having on forest regeneration.

Alongside the data gathered RPM staff increased their capacity for further monitoring with a team of 4 carrying out their first or second DNA survey new skills being learnt or learnt skills being developed.

12 | REFERENCES

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