# Estimating Himalayan tahr numbers in New Zealand

Why do we need tahr population estimates?

To manage tahr on Public Conservation Land (PCL) in the Southern Alps/Kā Tiritiri o te Moana we need estimates of the total population along with abundances in defined management units and exclusion zones.

- The Himalayan Tahr Control Plan (Department of Conservation 1993) defines the density that triggers intervention (i.e. the intervention density) in terms of number of tahr per km2 in each of seven management units (range: <1 to 2.5 tahr per km2) and two exclusion zones (0 per km2).

- The plan also sets a limit on total population to no more than 10,000 animals.

- However, insufficient monitoring data existed to enable tahr abundances in these management units and exclusion zones to be estimated.

- To address that knowledge gap, from 2016 to 2019 we conducted aerial surveys of tahr at 117 2 x 2 km sites (Fig. 1) across the seven management units and two exclusion zones.

# We used the following methods to estimate tahr abundance:

- Data collection: Aerial surveys to count tahr and other ungulates – known as tahr abundance helicopter count monitoring (Forsyth et al. 2014) – were conducted on three occasions from 2016 to 2019 (Forsyth et al 2018) at each of the 117 plots.

- Analysis: The repeat counts of tahr from the aerial surveys were used to estimate abundance, corrected for imperfect detection, using an N-mixture model for open populations (Dail & Madsen 2011).

- A simple exponential trend was assumed to model the changes in tahr abundance between successive sampling occasions (Humbert et al. 2009) to account for movement of tahr on or off the plot between surveys.

- Design-based, finite sampling methods were then used to estimate the total abundance of tahr on PCL as well as for each management unit and exclusion zone (Skalski 1994).
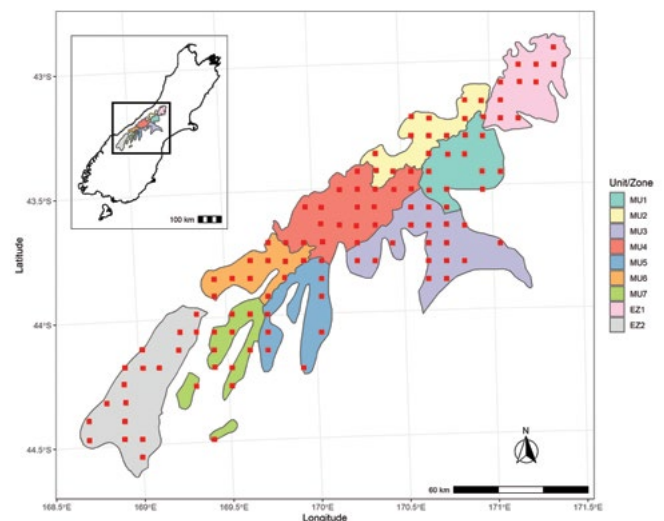
▲ Figure 1. Location of the seven tahr management units (MU1–7) and two exclusion zones (EZ1–2), and 117 aerial survey plots.

What the monitoring shows

- The total abundance of tahr on PCL for the period 2016–2019 was estimated to be 34,478 individuals (95% confidence interval: 26,522–44,821). This means we are 95% certain that the population mean falls between 26,522 and 44,821.

- Tahr abundances (Fig. 2) were highest in MU3 (approximately 8600 tahr) and lowest in MU7 (169 tahr) and the two exclusions zones (approximately 30–50 tahr).

- Average tahr density over the three years of sampling was
    – highest in MU5 (10.8 tahr/km2)
    – lowest in EZ2 (0.02 tahr/km2).
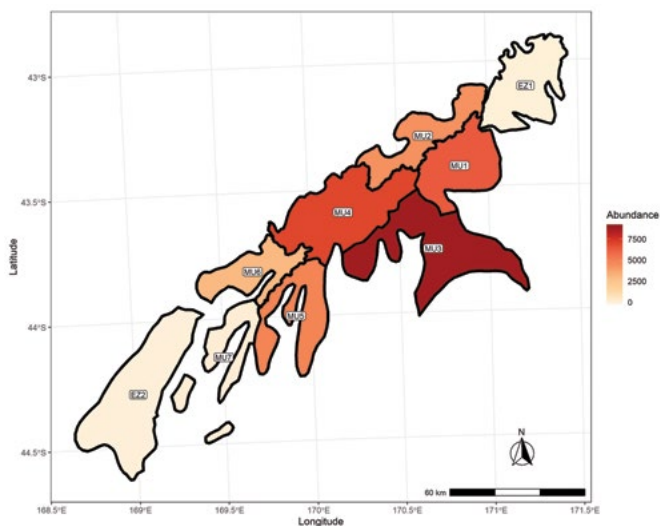
- It is important to note that the current estimate is an average abundance over the three seasons of data collection. This means we effectively average over any additions (tahr births) or losses (tahr deaths due to culling and natural causes) to the population during this period. The current estimate serves as a baseline which can be used to gauge future changes in tahr abundance due to management. Current work will inform recommendations about the minimum number of plots that need to be sampled in any one year to be able to gauge the effectiveness of tahr management in the future.

◄ Figure 2. Abundance of tahr within management units and exclusion zones surveyed from 2016 to 2019.

What this means

- While estimated tahr densities were highly variable within each of the seven tahr management units, average tahr densities exceeded the thresholds defined in the Himalayan Tahr Control Plan (Department of Conservation 1993; Table 1) for all management units except MU7. Average tahr densities also exceeded zero in both exclusion zones.

- The estimated total population of 34,478 tahr on PCL clearly exceeds the limit of 10,000 animals. Moreover, the lower 95% confidence limit of the estimate of total abundance is more than double the 10,000 animals limit. The tahr population estimates derived from data collected in 2016–2018 have been used to direct the current tahr control effort.

Can we improve precision of tahr density estimates at the management unit level?

- Despite additional monitoring data obtained for 51 plots in 2019, there was still high uncertainty around the estimated density of tahr for some management units. This uncertainty was due to high spatial variation in tahr density among plots within the management unit and the small number of plots sampled in some units.

- The precision of estimates of abundance for each management unit and exclusion zone could be improved by additional or alternative stratification (e.g. habitat-based strata). More-detailed maps of available tahr habitat across PCL would be needed for this.

- Further modelling of the relationships between tahr abundance and habitat variables is underway. Such model-based abundance estimates could improve the accuracy of tahr distribution mapping across each management area.

All photos: Dylan Higgison

References

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