

The 2024 aerial survey of forester kangaroos in Tasmania

Summary report

Report to the Department of Natural Resources and Environment Tasmania

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Executive Summary

In 2019, baseline aerial surveys were undertaken over central and north-eastern Tasmania to estimate the size and distribution of the forester kangaroo population. The survey was repeated in October 2024 using an identical method to maintain consistency. This report presents the results of the 2024 survey, and compares the results with the 2019 survey.

In 2024 forester kangaroos were counted over generally a larger survey area than in 2019. Changes to the survey boundaries in 2024 reflect the Department of Natural Resources and Environment Tasmania's priorities for fallow deer monitoring and management, as set out in the Tasmanian Wild Fallow Deer Management Plan, which had not been developed at the time of the 2019 survey.

To remain consistent with the 2019 results, the Forester kangaroo population density estimates for 2024 therefore needed to be calculated for only the area overlapping between the two surveys. This also meant the 2019 densities needed to be recalculated into this overlapping area, dropping any Forester sightings outside of the overlapping area, to ensure absolute consistency over the 5-year period.

The difference between the 2019 and 2024 population estimates in the overlapping area between the two surveys has shown an insignificant difference over the last 5 years from 24,948 +/- 24% forester kangaroos to 26,070 +/- 21% in 2024.

Introduction

The forester kangaroo (*Macropus giganteus tasmaniensis*) is Tasmania's largest marsupial. It is a familiar species in northern Tasmania but trends in its population abundance and distribution are not well understood. Historically, forester kangaroos had a wider geographical distribution, but the population contracted in size and distribution due to hunting. The extent of population recovery in recent decades is unclear.

The first baseline aerial survey to estimate forester kangaroo numbers and to map their distribution was done in September-October, 2019. In 2024, we repeated the survey to monitor for any change in the population over a five-year period.

The 2019 aerial survey

The main purpose of the 2019 aerial survey was to monitor Tasmania's fallow deer population. Forester kangaroos were surveyed over essentially the same region as deer, but with the survey footprint for kangaroos extending further into far north-eastern Tasmania, where there are no deer. The kangaroo survey area was therefore slightly larger than the deer survey area.

Analysis of the 2019 survey data indicated that the forester kangaroo population in central and north-eastern Tasmania had an average population density of ~ 1.4 animals per km^2 , and a conservative estimated minimum population size of just over 30,000 individuals. This was based on counts by two aerial surveyors.

Repeat of the aerial survey in 2024

In 2024 forester kangaroos were counted over generally a larger survey area than in 2019. Changes to the survey boundaries in 2024 reflect the Department of Natural Resources and Environment Tasmania's priorities for fallow deer monitoring and management, as set out in the Tasmanian Wild Fallow Deer Management Plan, which had not been developed at the time of the 2019 survey. To remain consistent with the 2019 results, the Forester kangaroo population density estimates for 2024 needed to be calculated for only the area overlapping between the two surveys. This also meant the 2019 densities needed to be recalculated into this overlapping area, dropping any Forester sightings outside of this overlap area, to ensure absolute consistency in the changes over this 5-year period.

Methods

Key principles of aerial wildlife surveys

When surveying wildlife populations over very large areas, it is not feasible to count every individual animal in the landscape. The approach used is therefore to count a representative and comprehensive sample of the population throughout the landscape.

Based on this count, the average population density (the average number of animals counted per km^2) is calculated. The average population density is then multiplied by the total area of the landscape that has been covered. This produces an estimated population size.

If the population is very unequally distributed within different parts of the landscape, then separate population estimates can be calculated for different areas for greater accuracy.

Depending on the survey (type of aircraft, the species being counted, whether one seat in the aircraft needs to be dedicated to a hazard spotter), either two or three aerial surveyors may count animals at the same time.

Approach used in 2024

The methods of the 2024 aerial survey remained consistent with the 2019 aerial survey methods so that the results can be compared fairly.

The survey took place in October 2024. The same flying height and ground speed were used as in the 2019 survey. Ground speed was held at 93 km per hour (50 knots), with a flying height of 61 m (200 feet) above ground level. The pilot used a GPS receiver to keep on track.

Surveys were done in the early morning and late afternoon. These are the times of day when animals were expected to be most active and therefore visible. Surveying was avoided when weather conditions would affect visibility of animals, or if the pilot considered the conditions unsafe to fly.

Survey area

A larger area of Tasmania (~26,000 km²) was surveyed for kangaroos in 2024 than in 2019 (~22,000 km²). The 2024 survey area was expanded to cover all management zones included in the *Wild Fallow Deer Management Plan 2022–27* (The Department of Natural Resources and Environment Tasmania, 2022).

The overlapping area between the 2019 and 2024 two surveys is shown in Figure 1, indicated by the cyan coloured air survey flight lines (in this case the 2024 transects). Both the 2024 and the 2019 densities were calculated into this overlapping area, dropping any Forester sightings outside of the overlap area. The 2019 transects are not shown. The subtle bends and small gaps along these flight lines reflect the operation's continued safety and avoidance procedures in planning to avoid high catenary electrical wires, towers and built-up areas.

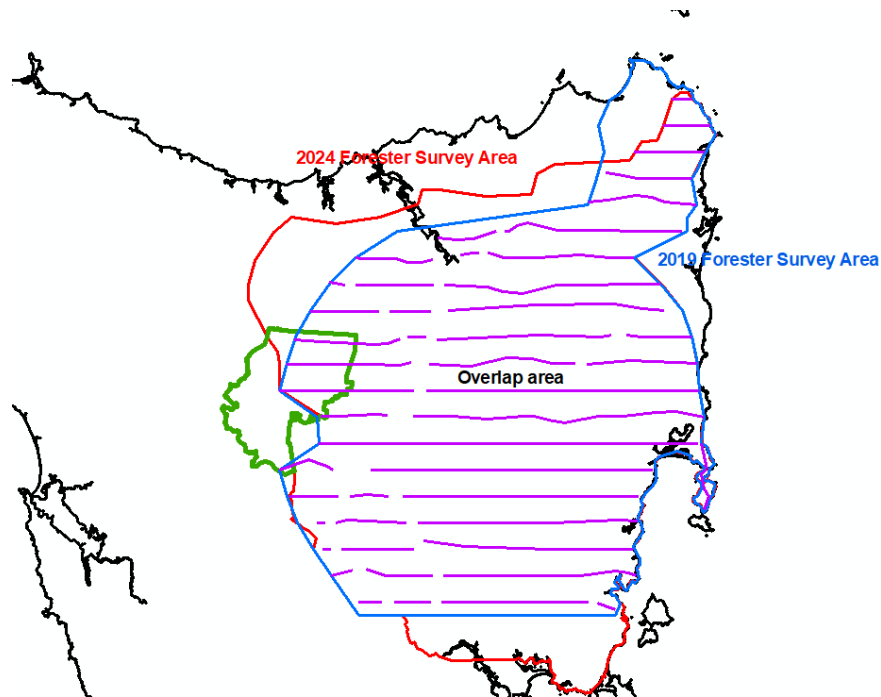


Figure 1: *Survey area differences in 2019 and 2024 in blue and red respectively. Transects (flight lines) flown in 2024 are shown in cyan. The 2024 transects have been trimmed for this calculation and indicate the overlapping area between the two surveys. An additional area of high conservation value, which is managed by the Tasmanian National Parks and Wildlife Service, was added onto the western side of the survey area to be more intensively surveyed for deer—marked green.*

The additional area of high conservation value, which is managed by the Tasmanian Parks and Wildlife Service, marked green in Figure 1 has a small amount of Forester data but is not used in the overlap area in the calculation of Forester density.

Aerial survey data collection

Data recording

The observers recorded their animal counts using electronic keypads. Electronic data entry meant that data was entered almost in real time, without observers having to look away from their field of view. This should result in fewer animals being missed in the counting.

The electronic keypads were attached to a computer that synchronised with the aircraft’s flying data. This means that data such as flying height, ground speed, and GPS location are logged automatically with all animal sightings. All data were recorded in a secure database that uses a proprietary file format, and cannot be accessed or edited by the surveyors.

The surveyors’ field of view out of the aircraft doors was divided into five sighting distance zones using marked poles mounted on the side of the helicopter. The poles were marked with zones that corresponded with distance classes on the ground of 0–20 m, 20–40 m, 40–70 m, 70–100 m, and 100–150 m away from the aircraft. These are the same sized zones that were used in the 2019 survey.

Analysis of aerial survey data

Principles of distance sampling

The main factor affecting how well observers can see and identify animals is how far away they are from the aircraft. Visibility drops off gradually with increasing distance, but the steepness of the decline varies from survey to survey because of the unique combination of factors affecting visibility during that survey (e.g. what species is being counted, if animals are stationary or moving, aircraft height, habitat, sun glare).

All population density estimates take this decline in sightability into account and compensate statistically for the declining chance of observers correctly counting and identifying animals the further away they are. This is the purpose of recording which sighting zone each animal is counted in (see above).

Methods used to estimate kangaroo population density & abundance in 2024

To obtain the best population estimates possible, the 2024 survey used a three-observer count, and mark-recapture distance sampling (MRDS; see above) to estimate forester population density and abundance for the entire survey area.

Alternative population estimates for 2024 were also calculated using two- and three-observer counts for the 2019 survey area, so they could be compared with the equivalent estimates from the 2019 survey (see Introduction).

First, the average population density for 2024 was calculated for the entire survey area using counts from two observers, and the mark-recapture statistic was calculated for the entire dataset. Population abundance was then estimated by multiplying the average density by the survey area and by the mark-recapture correction factor.

Equivalent population density and abundance estimates for 2024 were then calculated using kangaroo count data collected within the boundaries of the smaller 2019 survey area. The mark-recapture correction factor calculated from the entire 2024 dataset was applied to the density estimate for the smaller 2019 survey area. This approach was considered more reliable than calculating a mark-recapture correction factor for the smaller zone, because the sample size would be smaller.

The same calculations were done retrospectively for the 2019 survey data, minus the kangaroo count data collected in the 780-km² area of north-eastern Tasmania that was not re-surveyed in 2024.

An issue complicating the mark-recapture calculations for kangaroos in 2024 was that the observer counts sometimes disagreed on whether the macropods seen were forester kangaroos or Bennett's wallabies. In the open, these species are easily told apart on aerial surveys by size, gait, behaviour, and tendency of foresters to gather in large groups, but they can be harder to distinguish when stationary or partly hidden by foliage. For the purposes of calculating the mark-recapture statistic for 2024, where assessing sightability of animals was more important than which kangaroo species was seen, the counts for both macropod species were pooled. The mark-recapture statistic therefore assumes that the probability of misclassifying a forester as a Bennett's wallaby is equal to the probability of misclassifying a Bennett's as a forester.

Population density & distribution mapping

A population density map was produced for forester kangaroos for 2024. The map shows kangaroo population density as a gradient – with areas of higher and lower density arranged in concentric bands – in a similar way to a rainfall map.

Results

Forester kangaroo populations 2019 and 2024

In this report, three sets of population density and abundance estimates are provided in Table 1. These are over the full 2024 survey area, the 2019 area (called FD1) and the overlapping area of the two, all using the two-person distance sampling method called MCDS.

The difference between the 2019 and 2024 population estimates in the overlapping area between the two surveys has shown an insignificant difference over the last 5 years from 24,948 +/- 24% forester kangaroos to 26,070 +/- 21% in 2024 (Table 1).

For comparison only, the original 2019 FD1 area (the blue boundary in Figure 1) result from Lethbridge et al (2020) is shown (30,327 +/- 23%) and the 2024 forester estimate over the full area (the red boundary in Figure 1) is shown (27,617 +/- 21%).

Table 1 Comparisons of forester kangaroo population abundance estimates using two-observer (MCDS) estimates – 2019 & 2024

Survey year & boundaries	Area (km ²)	Population density & size estimates	
		Density (kangaroos per km ²)	Population size estimate
2019 results for the 2019 (FD1) survey area (blue)	21,958	1.381	30,327 (+/- 23%)
2019 results for the overlapping area only	21,178	1.178	24,948 (+/- 24%)
2024 results for the overlapping area only	21,178	1.232	26,070 (+/- 21%)
2024 results for the whole 2024 survey area (red)	26,005	1.062	27,617 (+/- 21%)

Notes:

1. The densities are only rounded to 3 decimal places. They can only be multiplied by the areas to their full precision, not shown here for brevity.
2. Red and blue references above refer to the red and blue survey boundaries in Figure 1.

Forester kangaroo population density distribution map

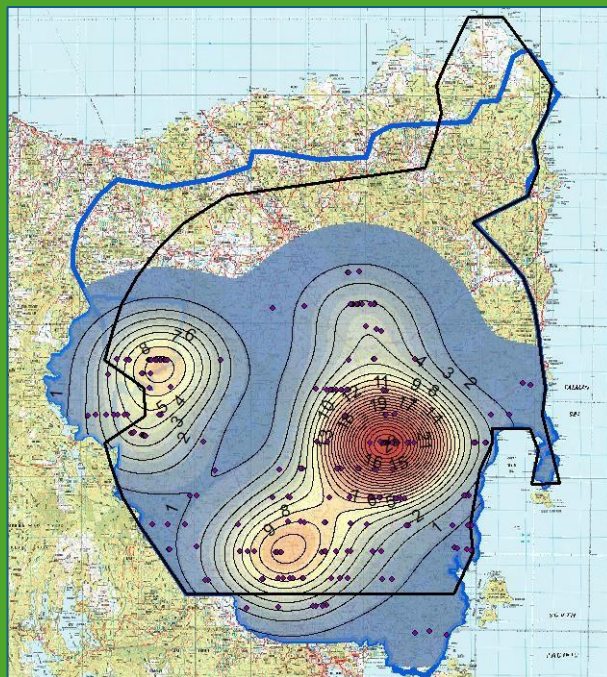
A gradient map showing forester kangaroo population distribution within the boundaries of the 2019 survey area is shown below (Figure 2). Areas with highest population density are shown in shades of red, and areas of lower density in shades of blue. Markers on the map show the locations of

kangaroo sightings. It is important to note that these markers may represent either individual animals, or multiple animals sighted together in one location, and are therefore not a tally of individuals.

Within the narrower boundaries of the survey area in far north-eastern Tasmania, no kangaroos were sighted in 2024. It is unknown how many kangaroos were still present in 2024 in the far west of this area that was not re- surveyed, and therefore how many kangaroos may have been missed in this area in 2024.

In 2024 the highest density of forester kangaroos was recorded south-west of Mona Vale near the Pringle Hills and Penny Hill. Some forester kangaroos were seen in locations where they have not previously been recorded. This included to the west, south and east of the Walls of Jerusalem National Park/Central Plateau Conservation Area, near Lake Saint Clair, Skullbone Plains and Kenneth Creek, with a handful south-west of Lake Augusta. A small number of foresters were also sighted near Pontville, north of Hobart. While it can sometimes be difficult to tell forester kangaroos apart from Bennett’s wallabies on aerial surveys, particularly in areas with tree canopy (see Methods), forester kangaroos were observed in the open in outlying areas in 2024, where they could be confidently identified.

Figure 2 Population density map of the Tasmanian forester kangaroo population, 2024



The black boundary shows the footprint of the 2019 survey area. The blue boundary is the 2024 survey area. Forester locations are shown as dots. Some Foresters were seen outside of the overlap area but not used in the calculation of density.

Discussion & recommendations

The difference between the 2019 and 2024 population estimates in the overlapping areas between the two surveys has shown a small but insignificant difference over the last 5 years. In 2024 forester kangaroos were observed in areas where they were not previously recorded, in the west, south and east of the expanded survey area. This does not accord with previous observations and expert knowledge of forester kangaroo distribution, and evidence for their presence in these areas would be strengthened by independent observations.

We suggest that it may be worth using citizen-science and camera trap observations to monitor for any expansion of the forester kangaroo geographical range outside the areas where they would normally be expected to be seen. It may be particularly worthwhile to place camera traps near to the novel sighting locations.

Citizen science reporting is vitally important for detecting expansion of species into new areas. It is already used to monitor the spread of fallow deer into new areas in Tasmania through project such as Tassie Deer Spotters iNaturalist Project and DeerScan. Monitoring for range changes in forester kangaroos could piggy-back on these efforts if landholders are alerted that forester kangaroos may be present.

References

Department of Natural Resources and Environment Tasmania (2022). *Wild Fallow Deer Management Plan 2022–27*. Government of Tasmania.

Lethbridge, M.R., Stead, M.G., Wells C. and Shute, E.R. (2020). *Baseline aerial survey of fallow deer and forester kangaroo populations, Tasmania*. Report to Tasmanian Department of Primary Industries, Parks, Water and Environment.

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