

Annual State-wide Spotlight Surveys Tasmania 2023/2024

REGIONAL SUMMARY

Contents

Overview	1
Priority Species	2
Brushtail Possums	4
Bennett's Wallaby	7
Tasmanian Pademelon	11
Non-harvested Species	14
Appendix 1. State average densities for the three priority species	18
Appendix 2. Raw counts of significant other species	20
Appendix 3. Management regions and survey routes	22

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Summary

The Department of Natural Resources and Environment Tasmania has been carrying out annual nocturnal spotlight surveys in Tasmania since 1975. The surveys were originally designed to monitor the harvested populations of Bennett's wallabies, Tasmanian pademelons and brushtail possums, however all observations of wild native and non-native mammal species are recorded. Surveys are conducted by vehicle along 190 x 10km transects across five management regions on mainland Tasmania and King and Flinders Islands. Each survey route follows an existing road and is 10 km long. The results of these surveys provide a long-term time-series of data for detecting population trends.

This report summarises the survey results for the three main target species, the Bennett's wallaby, Tasmanian pademelon and the brushtail possum from the 2023 surveys. Encounter rates are also provided for a range of other species.

Overview

The Department of Natural Resources and Environment Tasmania (NRE Tas) has been carrying out annual nocturnal spotlight surveys in Tasmania since 1975. The surveys were established to monitor the harvested populations of Bennett's wallabies, Tasmanian pademelons and brushtail possums, however all observations of wild native and non-native mammal species are recorded (see Appendix I for summary). Bennett's wallaby, Tasmanian pademelon and brushtail possum are three extremely abundant species that can cause significant economic damage to the agriculture and forestry sectors. These species are harvested either recreationally or via property protection permits at a localised level. Spotlight survey monitoring is undertaken to ensure that the take of these species is sustainable.

Surveys are undertaken across five management regions on mainland Tasmania and also on King and Flinders islands. The results of these surveys provide a long-term time-series of data for detecting population trends. Surveys were originally undertaken along forty-two survey routes, however following a review by Southwell (1985), the number of survey routes was increased to 132 and the methodology standardised for all surveys. Further survey routes were added between 1985 and 1990, resulting in 150 transects surveyed annually since 1990.

In 2002, further survey routes were added, and a change in methodology was made whereby the distance an animal was sighted from the survey route was noted, allowing the calculation of density indexes for the three most abundant species. In 2006, the system was further changed to record the age class (immature, juvenile, adult) and exact location of particular species including the Eastern quoll and Tasmanian devil.

As of 2009, there have been 190 survey routes spread across Tasmania: 172 on mainland Tasmania, 8 on Flinders Island and 10 on King Island. Appendix 2 gives an overview of the establishment of new survey routes since surveys began.

Each survey route follows an existing road and is 10 km long. Surveys are conducted by vehicle at a constant speed of 20 km/h, with the driver operating a hand-held spotlight. The driver relays their observations to a passenger for recording. The distance of each animal from the roadside is estimated, allowing a detection function to be modelled, and an estimate of species density produced. Population trends are analysed on a regional basis. Due to the inherent biases of surveying from roads, this estimate is intended as an index of density to monitor population trends. It is used to provide an indication of changes in relative abundance and should not be used for calculating estimates of population size. A more detailed description of survey methodology can be found in the *Tasmanian Spotlight Survey Manual*.

This report summarises the survey results for the three abundant harvested species, the Bennett's wallaby, Tasmanian pademelon and the brushtail possum from the 2023 surveys. Population trends are also shown since distance sampling methodology was first used in 2002.

2023 Surveys

The 2023 surveys were carried out by a number of staff from NRE Tas, primarily between late November 2023 and early January 2024. Surveys on Flinders Island were conducted in March 2024. Surveys on King Island were conducted in April, but results are not included in this report due to the data being unavailable at the time of analysis and publication. Data analysis and report writing was undertaken by staff from Wildlife Management within the Environment Strategic Business Unit.

Climatic conditions leading up to the survey period were variable across the state. El Nino was declared in Australia in September 2023 which rapidly followed on from predominantly La Nina conditions from November 2021 to March 2023. Winter was Australia's warmest on record with the national mean temperature 1.53°C warmer than the 1961-1990 average and the period August-October was the driest on record since 1900 (BOM 2024a).

Statewide rainfall for the year was below average for most of Tasmania tending towards near average for the west and north-east. Most of the State had average to below average rainfall each month from August onwards (BOM 2024b); the period which corresponds to annual spring vegetation growth and reproduction of native species. This is in contrast to the previous season (2022) whereby much of the east and midlands had above average rainfall in spring.

The mean maximum temperature for Tasmania as a whole for 2023 was very much above average being 0.94 °C above the 1961–1990 average and the fourth highest on record since 1910 (BOM 2024b). Similarly, the mean minimum temperatures for Tasmania 2023 were 0.68°C warmer than average for much of the State and very much warmer in the north. During Spring, the mean maximum and minimum temperatures were respectively 1.37°C and 0.38°C warmer than the 1961–1990 average (BOM 2024c). These combined environmental conditions of a dry spring and consequently low subsoil moisture and warmer weather resulted in limited grass growth, particularly along roadside verges. This, in turn, increases observation rates and detectability of wildlife (Lethbridge *et al* 2020).

Priority Species

In accordance with methods established by Dr Tony Pople, the 2023 spotlight survey data for Tasmania has been analysed. Density Index estimates have been calculated in the five mainland management regions and Flinders Island for the three abundant harvested species: the Bennett's wallaby; Tasmanian pademelon; and the brushtail possum. Statewide (mainland Tasmania) average density estimates are provided for each of these species in Appendix 1

Counts of other mammal species observed during the surveys on mainland Tasmania are given in Appendix 2.

Regional Surveys

Table 1 gives details of the number of surveys carried out in each region during 2023-24 and the numbers of animals sighted.

Table 1: Number of survey routes undertaken and mammals sighted 2023

Region	Survey Routes	Brush-tail Possum	Bennett's Wallaby	Tasmanian Pademelon	Other Native	Non- Native
Central	27	224	510	185	93	496
Flinders Island	8	67	1300	212	193	1
King Island	NA	NA	NA	NA	NA	NA
North East	59	222	483	716	107	76
North West	30	88	120	577	13	13
South East	44	255	709	623	112	115
South West	12	52	28	200	7	0
Total	180	908	3150	1247	513	701

Brushtail Possums

A summary of 2023-24 regional density indexes for the Brushtail possum is given in Table 2. The density indexes from 2014 to 2023 are given in Table 3 and Figure 1 depicts the density index for the period 2002 to 2023.

The results for density estimates for Brushtail possum for 2023 surveys indicate an increase in all regions when compare to the previous 2022 surveys. Estimates were the highest recorded (since 2002) for the North East, North West and Flinders regions and the second highest recorded for the South West and South East regions. Results were higher for the Central region but similar to many estimates calculated since 2007. The long-term population densities trends for all regions are stable except for the Central region which has a declining trend.

The statewide average density index for brushtail possum in 2023 was 53.3 animals per km² which is the second highest estimate since 'Distance' analyses started in 2002. This contrasts with detection of only 20.4 animals per km² in 2022, the lowest estimate recorded. Such contrasting results between years reflect low detectability due to increased vegetative growth (Lethbridge *et al.* 2020) combined with favourable productivity during La Nina years; as occurred in 2021 and 2020, followed by increased detectability and reduced vegetation growth during El Nino in Spring 2023. Although density estimates in 2023 were the second highest recorded, the long-term average statewide density trend indicates a slight decline in Tasmania (shown in Appendix 1).

Table 2: Regional Density Index Summary 2023: Brushtail Possum (BP)

	Density (n/km ²)	%CV	No. BPs	Length (km)	Enc. Rate (n/km)
Central	46.2	17.18	224	270	0.83
Flinders Island	59.1	50.34	67	80	0.84
King Island	NA	NA	NA	NA	NA
North East	64.2	40.30	222	590	0.38
North West	34.6	39.76	88	300	0.29
South East	68.0	30.22	255	440	0.58
South West	69.7	61.94	52	120	0.43

Table 3: Regional Density Index results 2014 – 2023: Brushtail Possum

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Central	51.9	37.1	56.3	48.7	29.9	50.4	49.9	68.0	23.7	46.2
Flinders Island	2.7	9.4	12.4	15.7	10.2	6.4	16.9	10.0	5.1	59.1
King Island	40.3	49.0	33.2	22.7	36.8	-	113	83.1	16.1	-
North East	27.8	27.8	20.7	23.6	29.1	27.2	19.4	22.3	15.1	64.2
North West	16.6	33.3	24.3	21.7	20.0	21.5	11.4	16.0	23.6	34.6
South East	23.1	31.1	13.7	28.8	21.6	24.9	31.5	28.3	19.1	68.0
South West	17.9	12.8	18.7	16.4	30.9	41.8	23.6	27.9	47.3	69.7

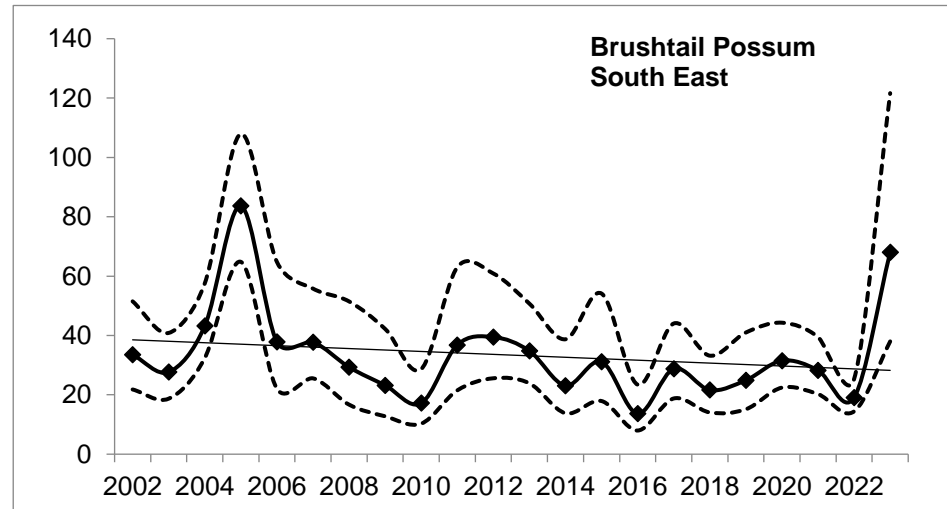
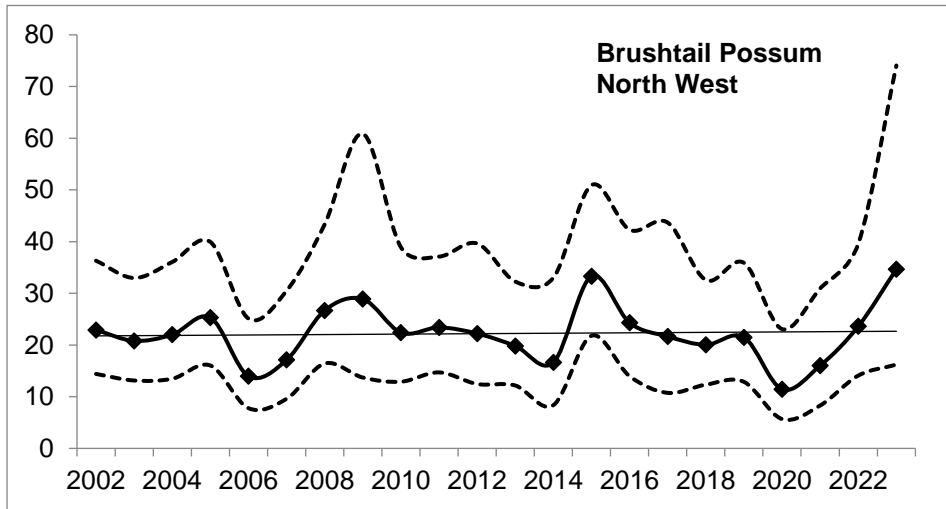
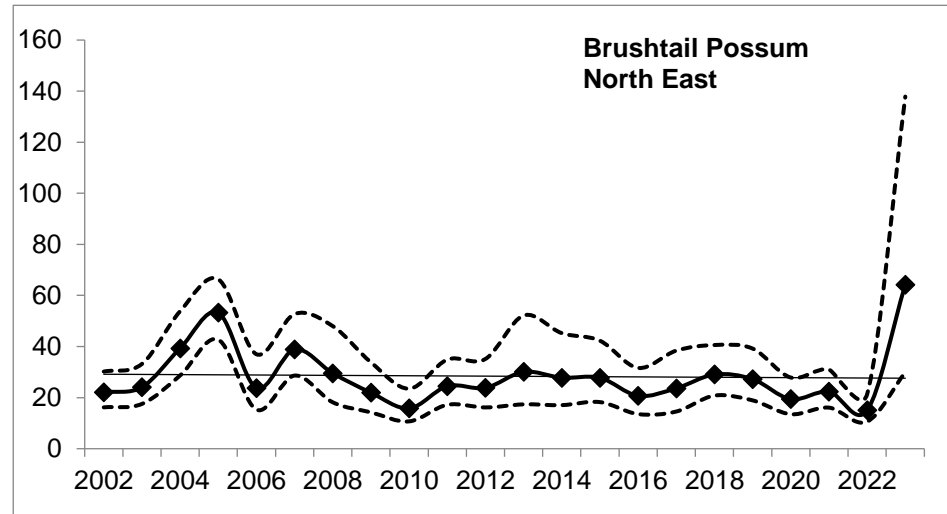
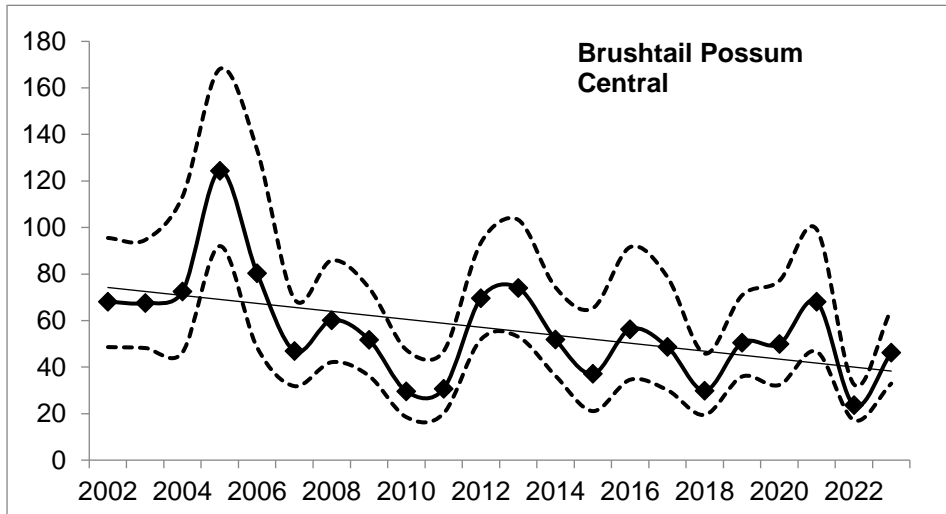


Figure I: Density index trends in each region – brushtail possums 2002-2023.

Dotted lines represent 95% confidence limits. Straight line is the long-term trend.

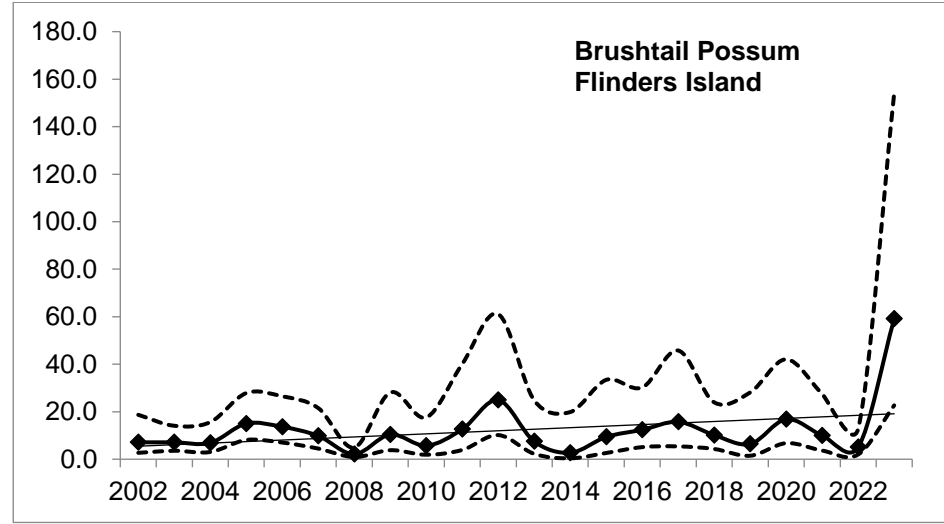
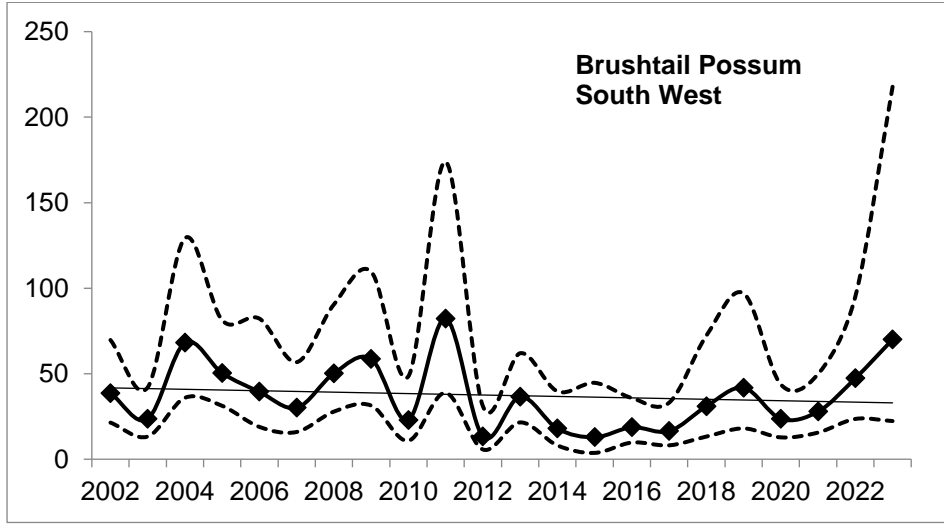


Figure I (continued): Density index trends in each region – brushtail possums 2002-2023.

Dotted lines represent 95% confidence limits. Straight line is the long-term trend.

Bennett's Wallaby

A summary of the 2023-24 regional density indexes for the Bennett's wallaby is given in

Table 4. The regional density indexes from 2014 to 2023 are shown in Table 5. Figure 2 depicts trends in the density index for the period 2002 to 2023.

The long-term trends for Bennett's wallaby for all regions in Tasmania are stable or increasing. All regions except the South West recorded an increase in density compared with 2022; the South West had a density estimate similar to those estimated annually since 2019. Flinders Island typically has a significantly higher density of Bennett's wallaby than the rest of Tasmania, and this result continued for 2023. The 2023 estimate was similar to estimates recorded between 2016-2021. Density estimates for Bennett's wallaby were the highest since 2016 for the North East and South East, and were the highest since 2018 for the North West. Estimates for the Central and South West regions were similar to recent years. The long-term population trends are increasing in the North West and on Flinders Island and are stable for the Central, North East, South East and South West.

The statewide average density index for Bennett's wallaby in 2023 was 47.4 animals per km². This estimate is the second highest calculated since 2002 and reflects favourable productivity of wet and warm environmental conditions associated with La Nina in 2021 and 2022 followed by increased detection probability and reduced vegetative growth associated with El Nino in Spring 2023. The long-term trend for Bennett's wallaby density for all Tasmanian regions is stable (Appendix 1).

Table 4: Regional Density Index Summary 2022: Bennett's Wallaby

	Density (n/km ²)	%CV	No. BW's	Length (km)	Enc. Rate (n/km)
Central	45.5	21.81	510	270	1.89
Flinders Island	185.0	21.84	1300	80	16.25
King Island	NA	NA	NA	NA	NA
North East	38.7	20.78	483	590	0.82
North West	38.7	34.49	120	300	0.40
South East	66.6	35.45	709	440	1.61
South West	20.8	34.14	28	120	0.23

Table 5: Regional Density Index results 2013 – 2022: Bennett’s Wallaby

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Central	78.2	56.5	29.6	51.7	46.9	52.2	46.0	48.8	29.8	45.5
Flinders Island	40.7	65.8	241.3	220.0	191.3	215.3	247.6	257.5	115.7	185.0
King Island	167.3	111.7	87.0	68.6	77.0	-	216.0	253.6	56.5	-
North East	39.8	42.6	33.1	21.9	32.0	31.4	23.3	27.9	20.9	38.7
North West	25.3	38.8	39.1	46.7	26.9	27.3	18.0	28.9	20.8	38.7
South East	41.0	108.7	19.8	38.2	22.1	48.7	31.3	19.8	27.0	66.6
South West	9.7	15.4	26.5	23.7	8.6	18.8	20.0	16.5	22.3	20.8

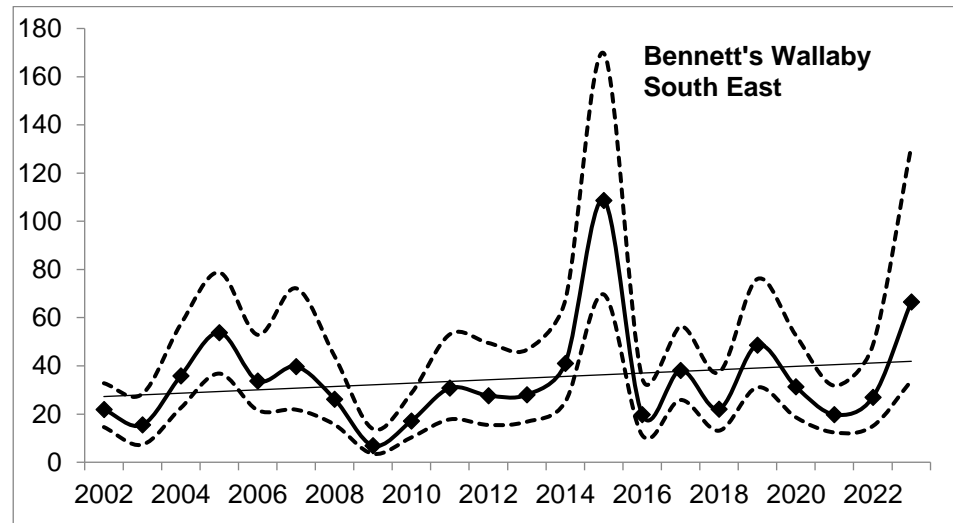
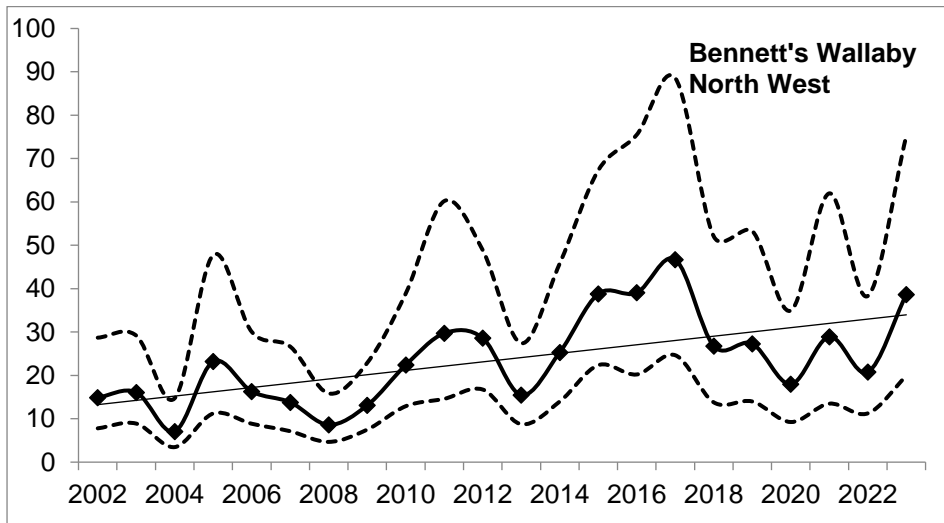
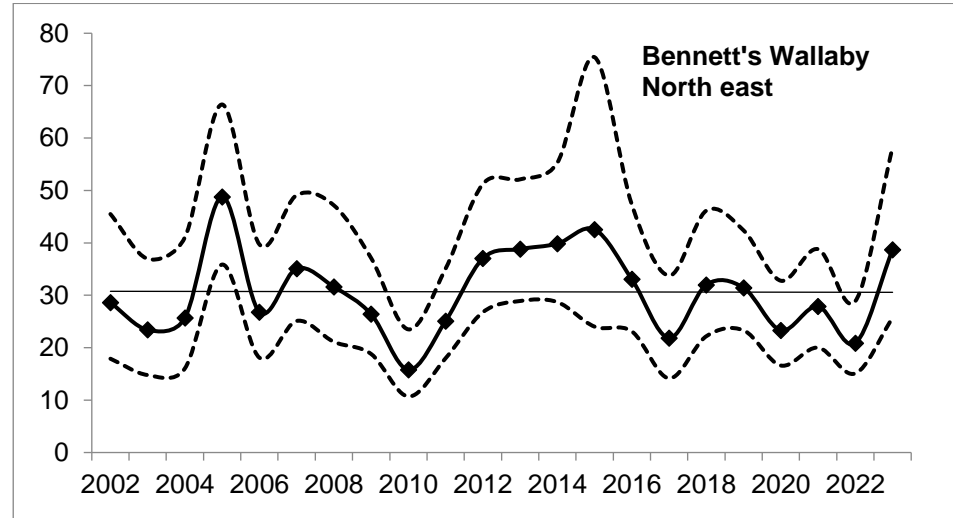
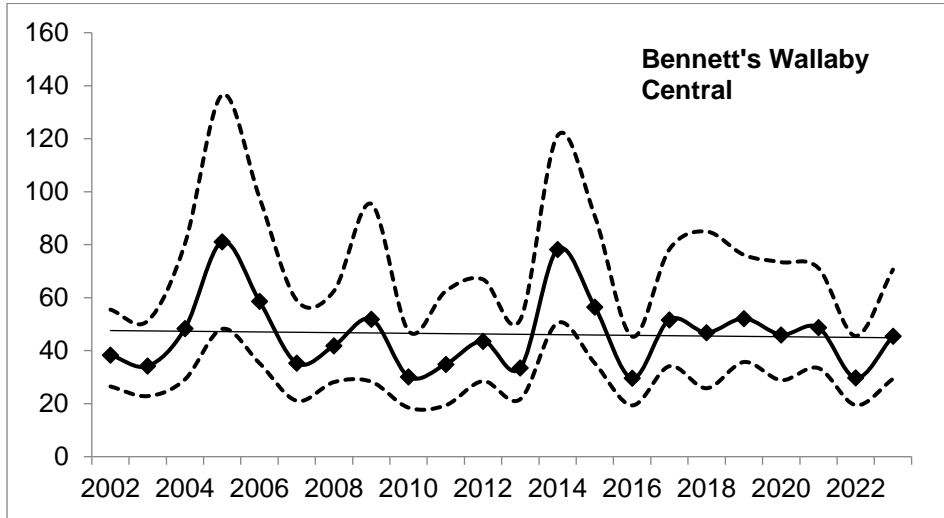


Figure 2: Density index trends in each region – Bennett’s wallaby 2002-2023.

Dotted lines represent 95% confidence limits. Straight line is the long-term trend

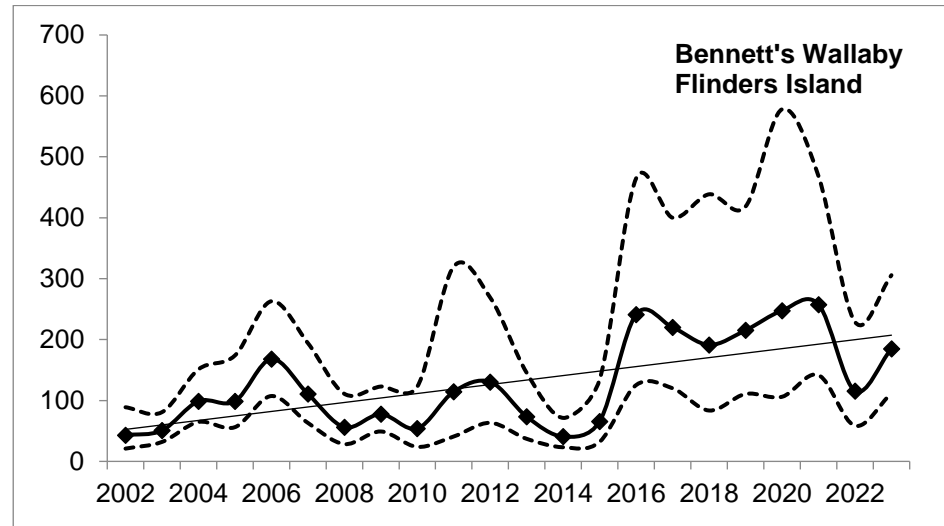
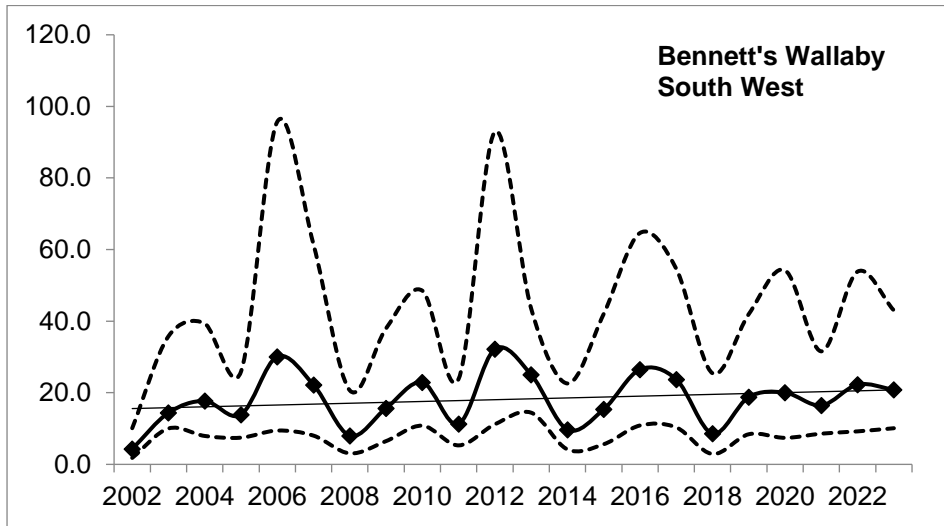


Figure 2 (continued): Density index trends in each region – Bennett’s wallaby 2002-2023.

Dotted lines represent 95% confidence limits. Straight line is the long-term trend.

Tasmanian Pademelon

A summary of the 2023-24 regional density indexes for Tasmanian pademelon is given in Table 6. The density indexes from 2014 to 2023 are given in Table 7 and Figure 3 depicts the density indices for each Region for the period 2002 to 2023.

The population density index estimates for Tasmanian pademelons for 2023 surveys indicate an increase in all regions when compared to the previous 2022 surveys. Estimates were the highest for all regions, except Flinders Island, since 2019 and were the highest since 2015 for the Central region. The long-term population trend for pademelons is stable across the north of the State (North West and North East regions). Population index trends are declining in the Central region despite the increase in 2023. Trends are declining on Flinders Island and declining slightly in the South East. Long-term density estimates are increasing for the South West region but caution needs to be taken when interpreting these results due to the relatively low number of animals counted and the low detectability away from roads due to the thick vegetation.

The statewide density index for Tasmanian pademelons in 2023 was 67.4 animals per km². This is the highest density estimate since 2019 and close to the long-term stable trend since 2002 (shown in Appendix I).

Table 6: Regional Density Index Summary 2023: Tasmanian pademelon

	Density (n/km ²)	%CV	No. TP's	Length (km)	Enc. Rate (n/km)
Central	36.43	27.32	185	270	0.69
Flinders Island	54.6	48.57	212	80	2.65
King Island	NA	NA	NA	NA	NA
North East	76.5	16.91	716	590	1.21
North West	102.37	18.06	577	300	1.92
South East	54.2	30.17	623	440	1.42
South West	258.1	31.9	200	120	1.67

Table 7: Regional Density Index results 2014 – 2023: Tasmanian pademelon

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Central	42.5	45.7	10.54	25.5	20.0	29.0	16.44	19.11	13.1	36.4
Flinders Island	83.7	45.4	121.5	120.0	64.6	81.9	29.17	57.18	40.1	54.6
King Island	13.4	18.9	8.2	10.0	12.4	-	9.45	1.05	5.9	-
North East	109.3	119.1	78.9	53.7	60.0	121.7	61.83	49.25	47.9	76.5
North West	121.8	157.2	180.0	117.9	80.2	129.7	77.76	94.15	76.9	102.4
South East	37.2	76.7	33.1	48.1	32.5	56.4	3271	29.17	21.4	54.2
South West	22.2	46.5	103.4	100.0	24.1	93.4	159.63	106.94	132.4	258.1

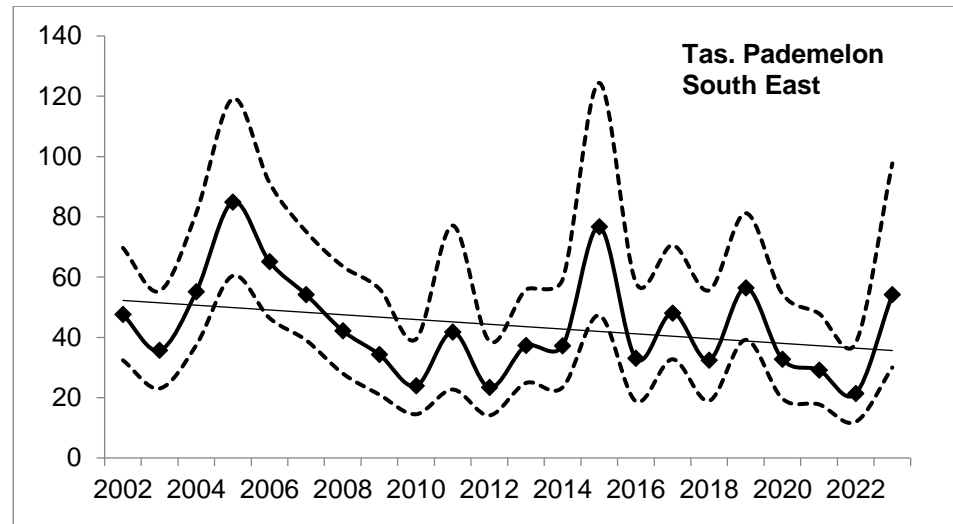
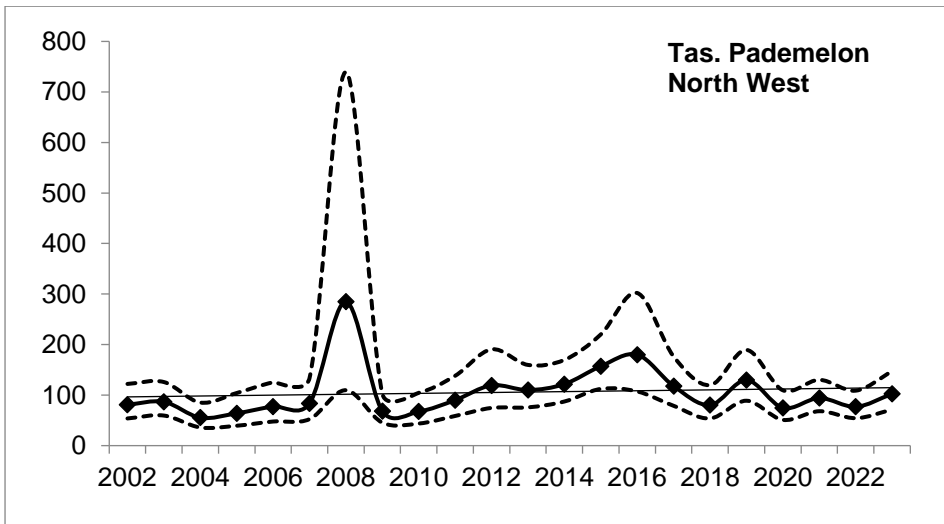
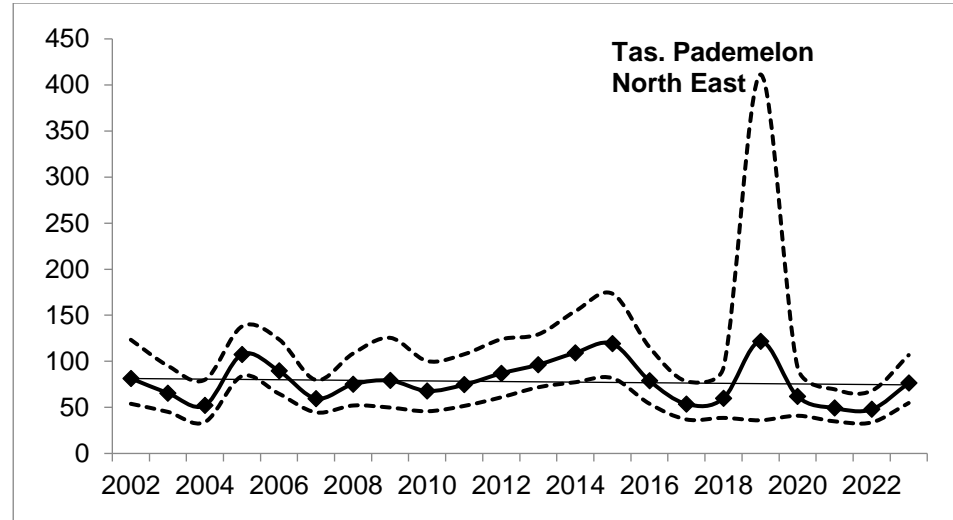
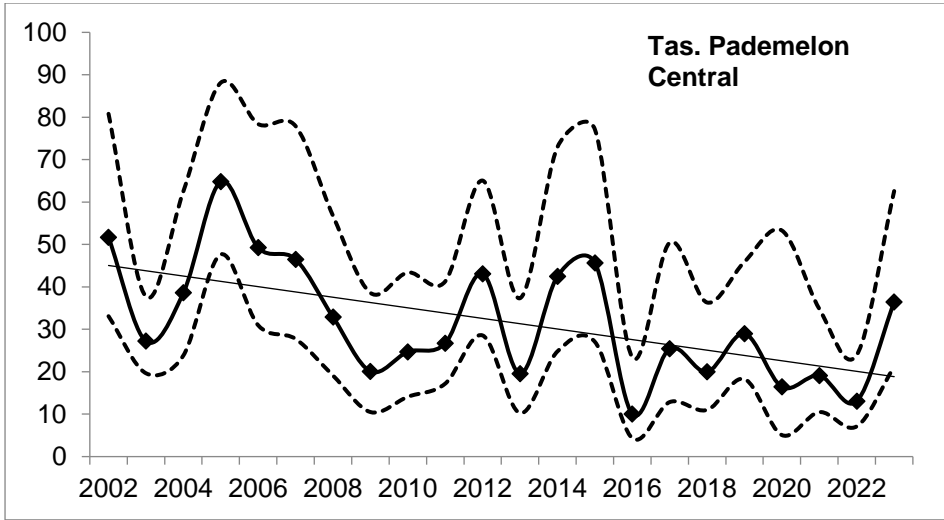


Figure 3: Density index trends in each region – Tasmanian pademelon 2002-2023.

Dotted lines represent 95% confidence limits. Straight line is the long-term trend.

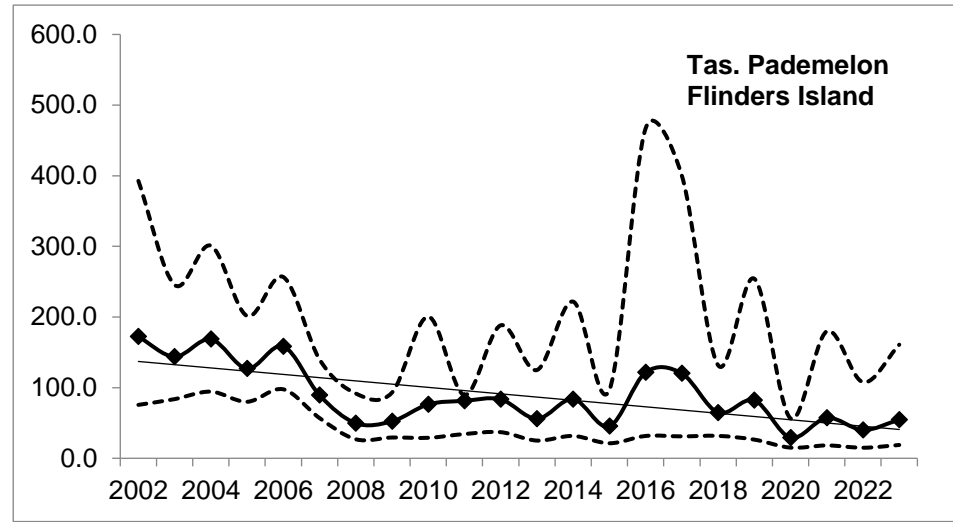
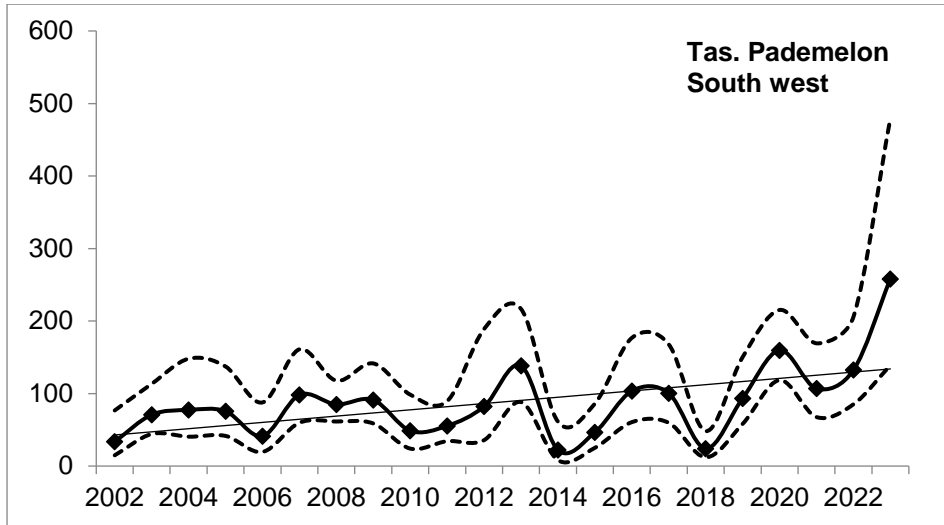


Figure 3 (continued): Density index trends in each region – Tasmanian pademelon 2002-2023.

Dotted lines represent 95% confidence limits. Density is measured in individuals per square kilometre.

Non-harvested Species

While the statewide spotlight surveys are designed specifically to monitor the three harvested species, the surveys also enable the collection of data for other species. Insufficient data is collected for these species to allow density analysis to be undertaken due to their lower abundance and/or lower detectability. However, the raw counts and encounter rates (number of a given species observed per 10 kilometre transect) provide information which can be a useful indicator of population trends. Raw counts of a range of species are provided in Appendix 2, and trends in encounter rates are provided in Figures 4 and 5.

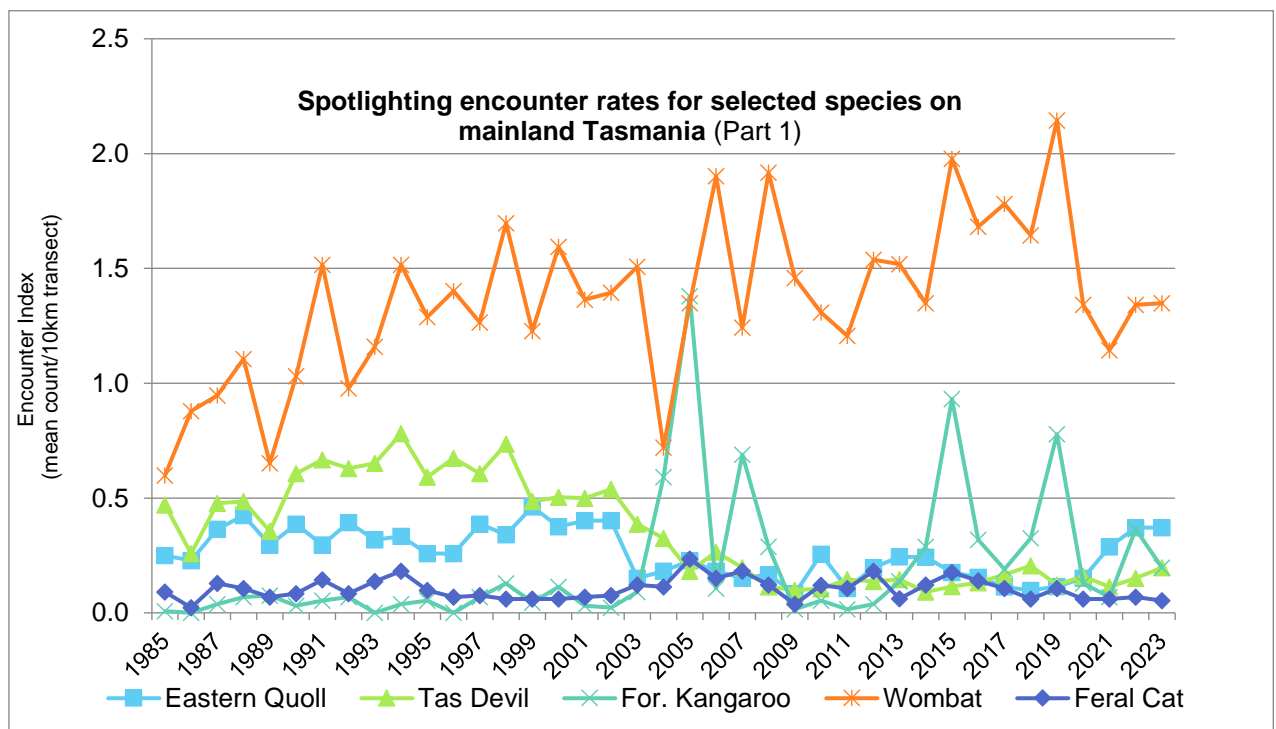


Figure 4: Encounter rates for selected species on mainland Tasmania* (Part I)

*Based on the 132 transects conducted continuously since 1985

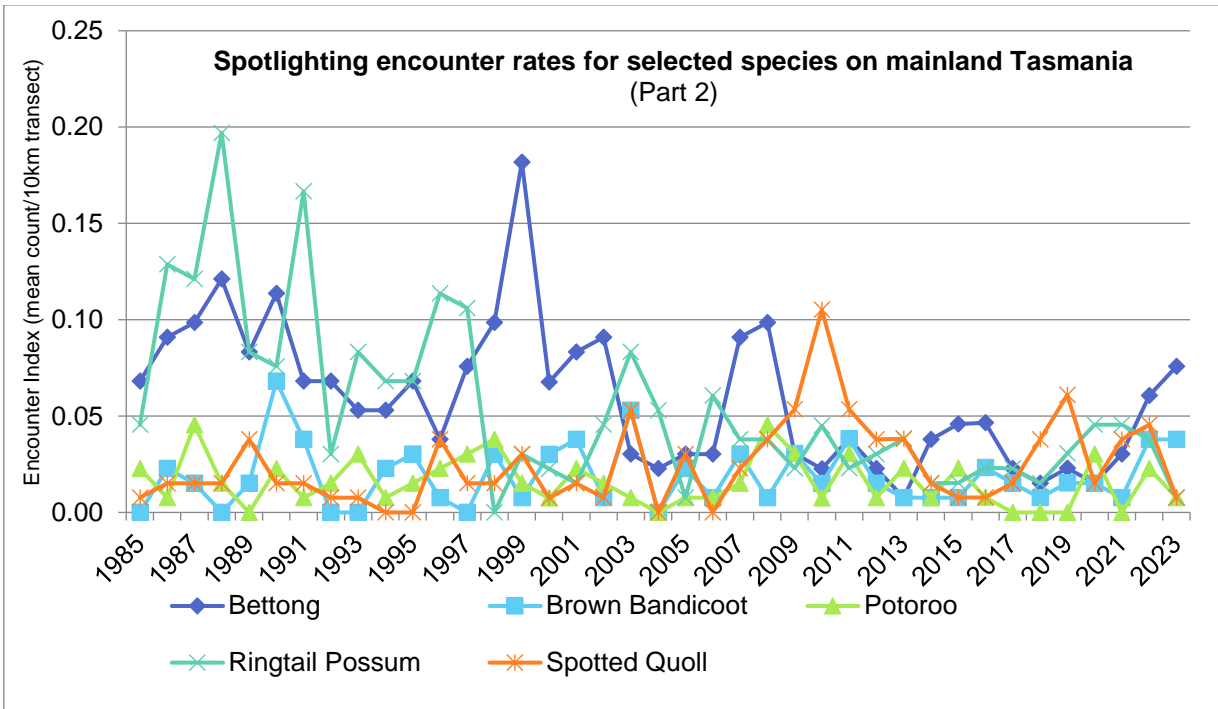


Figure 5: Encounter rates for selected species on mainland Tasmania* (Part 2)

*Based on the 132 transects conducted continuously since 1985

As a consequence of the progressive addition of survey routes since the original survey was established in 1975, it is possible to provide a range of presentations based on the data set used and the timeframes represented. The later data sets (post 1985) are statistically more rigorous due to their larger sample size; however, the earlier 1975 series (i.e. those 42 transects that have been run continuously since 1975) provide a longer, but statistically less robust, perspective of population trends. Trends in encounter rates based on the 1975 data series for 5 species are provided in Figure 6.

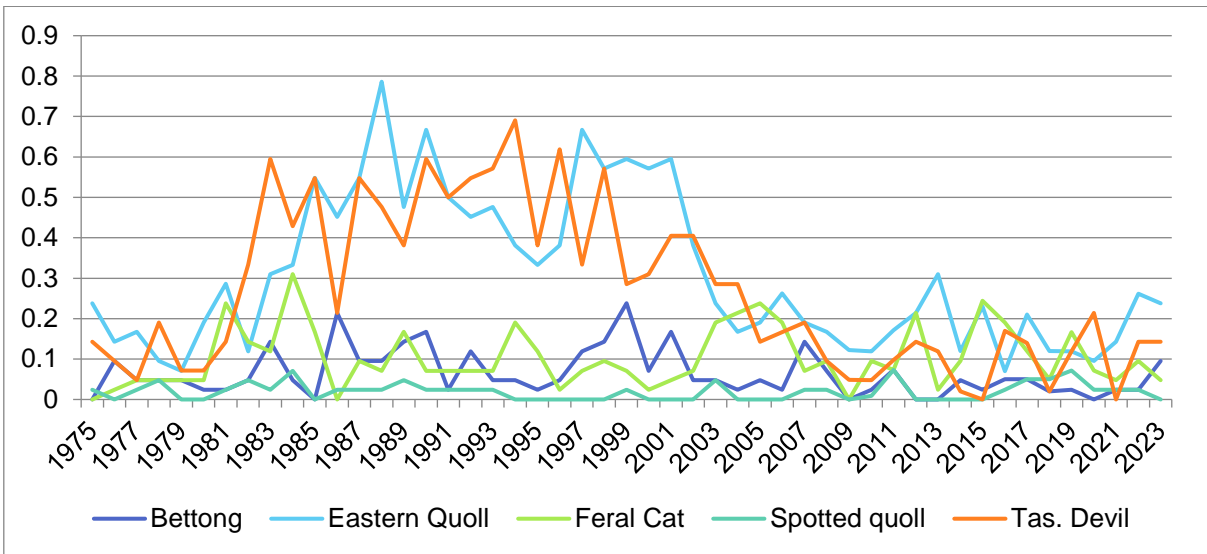


Figure 6: Encounter rates for selected species on mainland Tasmania -1975 data series*

*Based on the original 42 transects conducted continuously since 1975

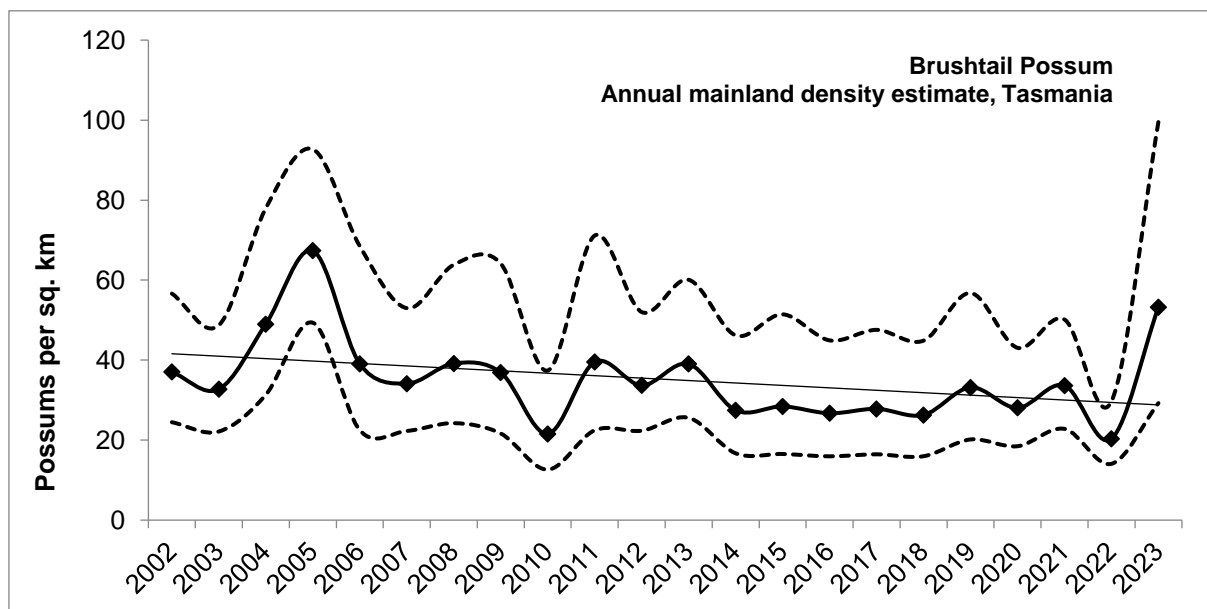
Due to the very low encounter rates it must be stressed that these data (1975 series) should be interpreted with caution. Trends of particular interest include the apparent cessation, or slowing, in decline and subsequent plateauing of encounter rates of eastern quoll and Tasmanian devil to levels similar to those observed in the 1970s. This contrasts with the continued declines estimated by Cunningham *et al.* (2022) for eastern quoll. There also appears to be an absence of a major change in feral cat encounter rates over the period 1975-2023 despite the considerable changes in the Tasmanian devil and eastern quoll encounter rates over the same period.

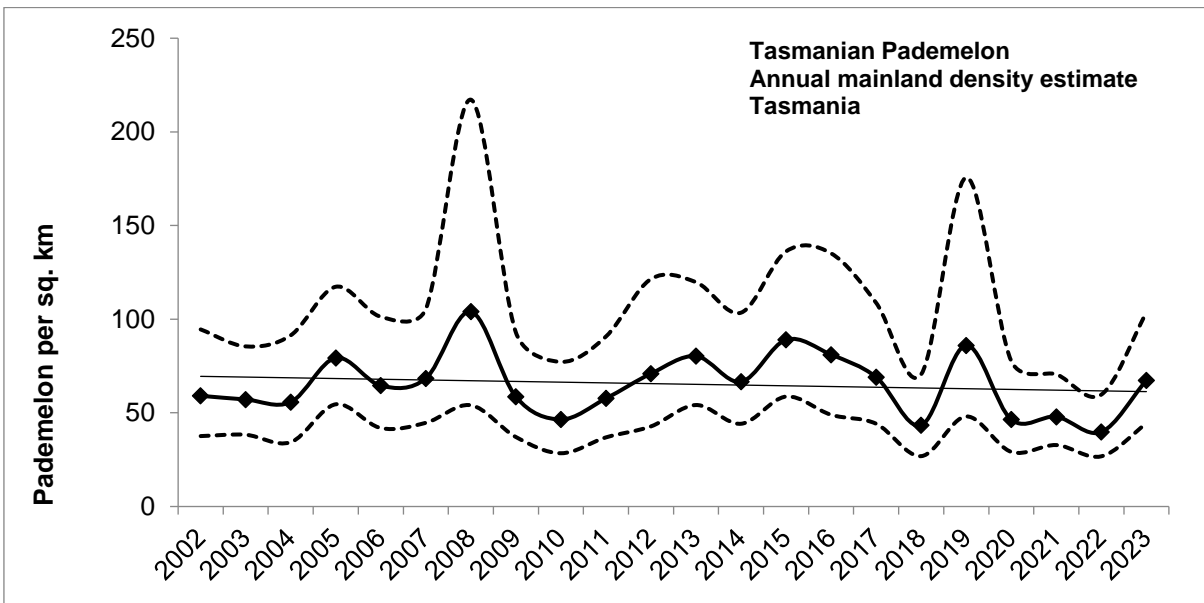
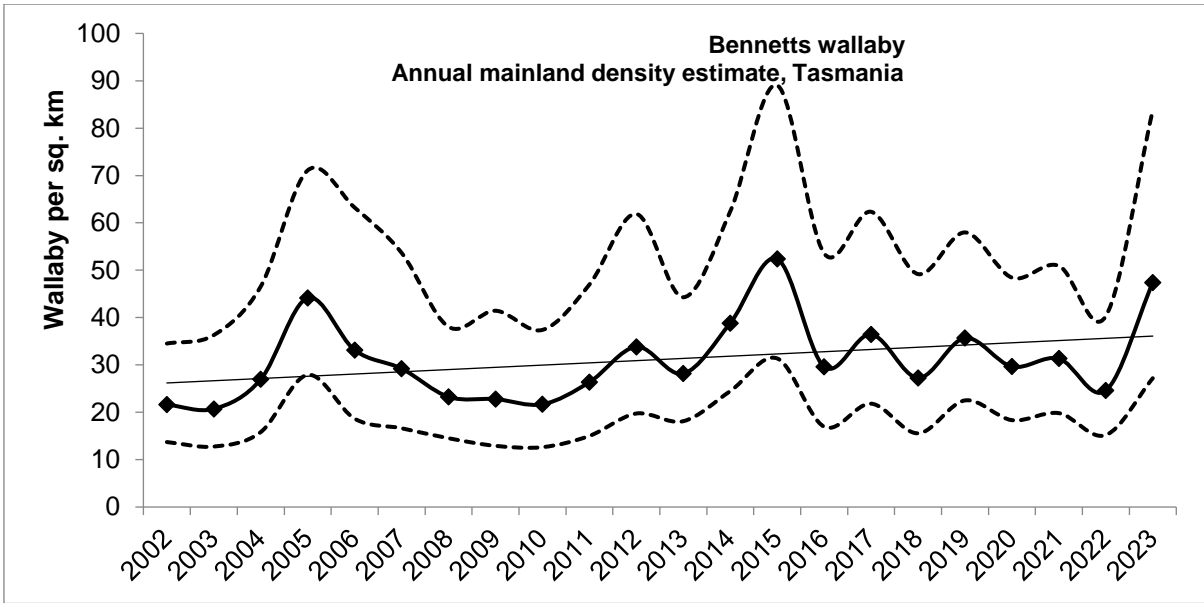
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Appendix I. State average densities for the three priority species

Note: the average densities shown below are calculated as a simple mean of the regional density estimates, rather than using the statewide density estimate as calculated by the Distance program. The reason for this is the Distance program uses a 'weighted' mean based on the number of transects in a region, this could bias the results by minimising the input from the South West region because there are only 12 transects in that region compared with, for example, the North East, which has 59 transects. Conversely, the small sample size in the South West region means that there is greater potential for survey specific bias (weather, timing of survey) to affect the result. Consequently, the State average shown here (with the long-term trend line) should be viewed with caution; regional densities provide a significantly more robust indication of density and trends and are used to guide management.





Appendix 2

Table 1: Raw counts of other mammal species observed during the Annual Statewide Spotlight Surveys, mainland Tasmania 2002-2023.

MAINLAND TASMANIA		COUNT												
		Native Species										Non-native Species		
Year	# Surveys Routes	Tasmanian Devils	Spotted- tailed quoll	Eastern quoll	Forester kangaroo	Tasmanian bettong	Eastern barred bandicoot	Southern brown bandicoot	Common wombat	Ringtail possum	Long- nosed potoroo	Fallow deer	Feral cat	Rabbit
2002	172	87	1	69	3	23	4	1	257	9	3	149	19	155
2003	173	64	8	30	12	7	3	7	242	21	2	160	20	168
2004	173	51	0	57	86	11	1	0	128	14	0	256	21	129
2005	172	36	5	55	183	7	1	3	227	3	1	619	33	311
2006	173	46	1	42	15	12	4	4	313	11	1	449	25	249
2007	172	32	3	43	91	18	0	5	215	6	2	231	28	197
2008	170	19	5	41	40	25	2	1	294	7	6	165	20	289
2009	172	18	7	20	45	19	6	5	262	5	5	80	9	187
2010	172	19	13	45	5	6	4	2	193	9	2	113	21	191
2011	171	20	10	25	2	13	2	7	200	4	4	154	14	194
2012	172	21	5	36	6	9	2	2	242	4	1	392	27	144
2013	171	21	5	44	18	6	3	2	251	5	7	258	13	125
2014	172	12	3	44	38	11	7	2	214	3	1	434	22	113
2015	171	15	1	30	122	15	1	2	313	2	3	808	33	147
2016	168	17	2	27	41	9	8	3	273	3	3	223	24	106
2017	172	24	2	23	25	4	3	2	283	4	2	613	15	97
2018	172	28	6	23	43	7	2	1	259	2	0	793	11	75
2019	172	20	10	26	102	6	11	2	325	4	0	576	18	97
2020	172	32	3	30	17	3	5	3	205	7	4	693	12	71
2021	171	18	5	43	9	8	3	2	191	9	0	652	8	76
2022	172	23	7	63	48	11	13	6	215	7	3	551	12	85
2023	172	41	3	57	27	16	10	5	214	2	1	587	8	68

Table 2: Raw counts of additional mammal species observed during the Annual Statewide Spotlight Surveys, Flinders Island 2002-2023.

FLINDERS ISLAND		Count			
Year	# Surveys	Common wombat	Ringtail possum	Long-nosed potoroo	Feral cat
2002	16	30	0	0	1
2003	16	45	3	1	10
2004	16	73	0	0	4
2005	16	110	0	0	3
2006	16	112	1	0	5
2007	16	68	0	0	8
2008	16	41	0	0	0
2009	16	51	0	0	2
2010	16	55	0	0	1
2011	8	18	0	0	0
2012	8	62	0	0	2
2013	8	68	0	0	4
2014	8	41	0	0	2
2015	8	49	0	0	1
2016	8	54	0	0	1
2017	8	132	0	0	1
2018	8	105	0	0	5
2019	8	83	0	0	3
2020	8	111	0	0	0
2021	8	83	1	0	2
2022	8	95	0	0	0
2023	8	193	0	0	1

Table 3: Raw counts of additional mammal species observed during the Annual Statewide Spotlight Surveys, King Island 2002-2022

KING ISLAND		Count	
Year	# Surveys	Feral cat	Fallow deer
2002	10	0	Not Present
2003	20	0	Not Present
2004	20	5	Not Present
2005	20	5	Not Present
2006	20	2	Not Present
2007	10	0	Not Present
2008	10	2	0
2009	10	4	0
2010	10	0	0
2011	No survey	No survey	No survey
2012	10	2	0
2013	10	2	0
2014	10	1	0
2015	10	3	0
2016	10	0	3
2017	10	5	0
2018	10	1	0
2019	No survey	No survey	No survey
2020	10	5	1
2021	10	1	0
2022	10	1	0
2023	-	-	-

Appendix 3. Management regions and survey routes

The management regions reflect the areas covered by the existing population-monitoring program and correlate closely with IBRA bioregions. These regions are presented in Figure 7.

South West Region (20,490 km²)

The South west region is the largest of the regions, extending from Sandy Cape on the west coast to New River Lagoon on the south coast. The area consists predominantly of the World Heritage Area and other conservation reserves, with very little agricultural activity taking place in most of the region.

South East Region (12,610 km²)

The South east region extends from New River Lagoon on the south coast to Long Point on the east coast. It adjoins the southwest, central and northeast regions. This region includes the D'Entrecasteaux Channel area, the Tasman Peninsula, and much of the Derwent River Valley and the east coast. This region is highly developed for agriculture, including high-value crops, and therefore there is a large demand for crop protection permits.

Central Region (9,041 km²)

The Central region is bounded by all other regions and encompasses much of the Central Plateau and the Midlands. The Midlands area has been highly modified since European settlement and is dominated by agricultural land use. In particular, the loss of natural habitat through native vegetation clearance and the growing of crops have seen the encroachment of browsing wildlife onto farming properties and they have particularly flourished in this region.

North East Region (11,300 km²)

The North east region extends from Long Point on the east coast to the mouth of the Rubicon River on the north coast. It encompasses the hinterland south of Launceston to Longford and westward to Westbury, as well as the Tamar Valley and the Fingal Valley in the south. This region has several important agricultural areas, particularly in the vicinities of Longford and Scottsdale as well as the northeast coast.

North West Region (9,949 km²)

The Northwest region extends from Liffey at the boundary of the Central region through Westbury to the north coast and to Sandy Cape on the west coast. It includes the far northwest as well as the Smithton, Somerset, Burnie, Devonport and Deloraine areas. Impacts to farming activities on high value agricultural lands are felt in the region although to a lesser extent than the central region due to the larger area of natural habitat available to browsing wildlife.

Flinders Island (1,333 km²)

Eight spotlight survey routes were established on Flinders Island in 1991 and were surveyed twice each fiscal year until 2010. Since then they have been surveyed only once per year.

King Island (1,098 km²)

Ten spotlight survey routes were established on King Island in 2001 and until 2006 they were surveyed twice each fiscal year. Since then they have been surveyed only once per year, although no surveys were undertaken in 2011 and 2019. Surveys have been undertaken in 2023 but were not included in this report.

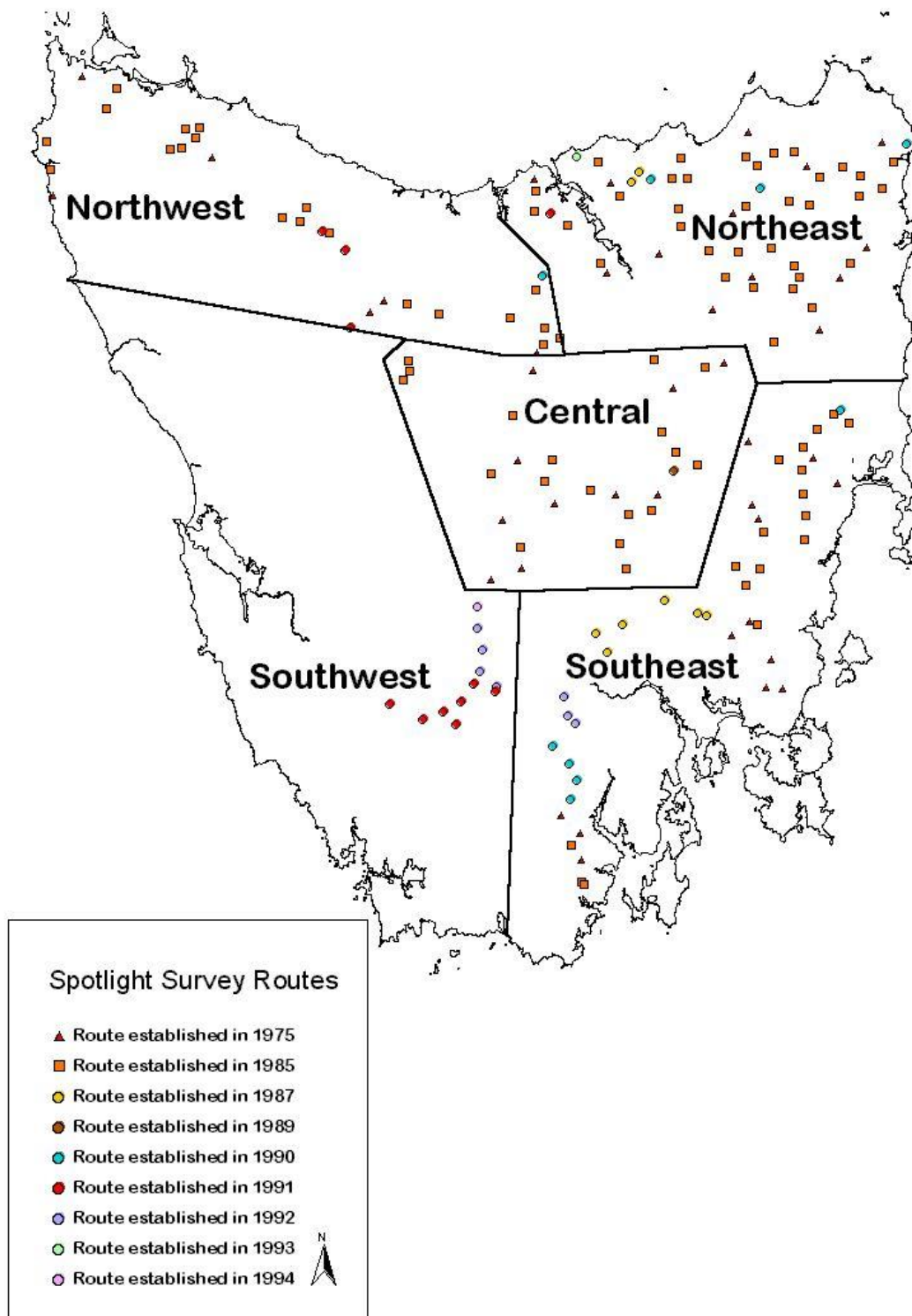


Figure 7: Management regions and survey routes for wildlife population monitoring, mainland Tasmania.



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