

# Annual Statewide Spotlight Surveys Tasmania 2019/2020

## Regional Summary: Priority Harvested Species



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## Summary

The Department of Primary Industries, Parks, Water and Environment 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 across five management regions on mainland Tasmania and also on 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 2019 surveys. Encounter rates are also provided for a range of other species.

## Table of Contents

<b>SUMMARY</b> .....	1
<b>OVERVIEW</b> .....	3
<b>PRIORITY SPECIES</b> .....	4
<b>BRUSHTAIL POSSUM</b> .....	5
<b>BENNETT’S WALLABY</b> .....	8
<b>TASMANIAN PADEMELON</b> .....	11
<b>NON-HARVESTED SPECIES</b> .....	14
<b>APPENDIX 1: Statewide average densities</b> .....	17
<b>APPENDIX 2: Raw counts of significant other species</b> .....	19
<b>APPENDIX 3: Management regions and survey routes</b> .....	21

## Overview

The Department of Primary Industries, Parks, Water and Environment have 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 1 for summary).

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 fifty-one 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 steady 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 is 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 but 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 2019 surveys. Population trends are also shown since distance sampling methodology was first used in 2002.

### 2019 Surveys

The 2019 surveys were carried out by a number of staff from the Natural and Cultural Heritage Division, DPIPW between November 2019 and February 2020. Data analysis and report writing was undertaken by staff from Wildlife Management.

Climatic conditions leading up to the survey period were warm and dry to very dry across the state, particularly during spring. This is in keeping with much of eastern Australia where drought conditions were experienced and declared over extensive areas (BOM 2019a). Extreme heat and fire weather were also experienced across eastern Australia during December 2019 and January 2020 with a record high temperature for Australia recorded on 18 December 2019 (BOM 2020). Catastrophic bushfires occurred from September 2019 through to March 2020

throughout Queensland, New South Wales, Victoria and South Australia with more than 18 million hectares burnt.

Surveys were unable to be conducted on King Island during the 2019 Spotlight season due to limited resources.

## Priority Species

In accordance with methods established by Dr Tony Pople, Wildlife Management, DPIPWE, has reviewed the 2019 spotlight survey data for Tasmania and calculated Density Index estimates 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) average density estimates are provided for each of these species in Appendix 1

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

### Regional Surveys

Table 1 gives details of the number of surveys carried out in each region during 2019 and the numbers of animals sighted.

**Table 1: Number of survey routes undertaken and mammals sighted 2019**

Region	Survey Routes	Brushtail Possum	Bennett’s Wallaby	Tasmanian Pademelon	Other Native	Non- Native
Central	27	298	402	169	135	470
Flinders Island	8	21	637	293	83	3
King Island	-	-	-	-	-	-
North East	59	234	425	1221	174	124
North West	29	98	180	769	52	17
South East	44	281	791	680	140	105
South West	12	66	31	114	8	0
<b>Total</b>	<b>179</b>	<b>998</b>	<b>2466</b>	<b>3246</b>	<b>592</b>	<b>719</b>

## Brushtail Possums

A summary of 2019 regional density indexes for the Brushtail possum is given in Table 2. The density indexes from 2010 to 2019 are given in Table 3 and Figure 1 depicts the density index for the period 2002 to 2019.

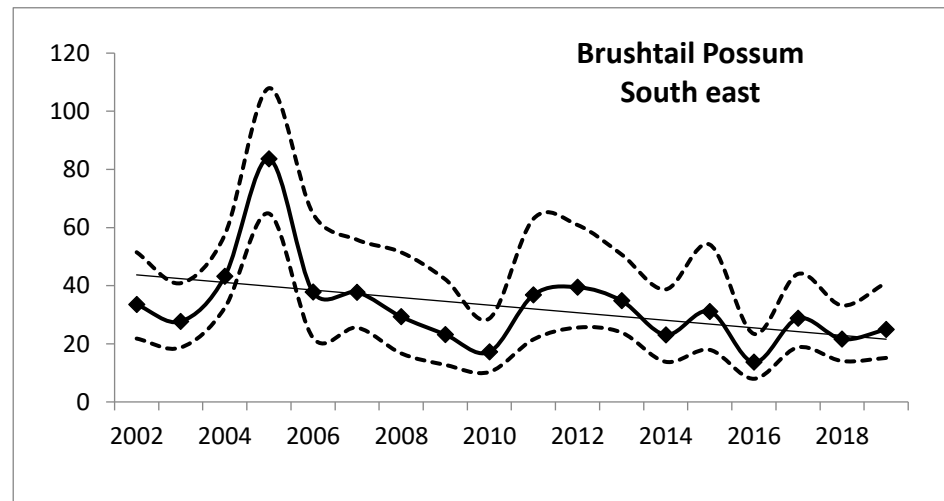
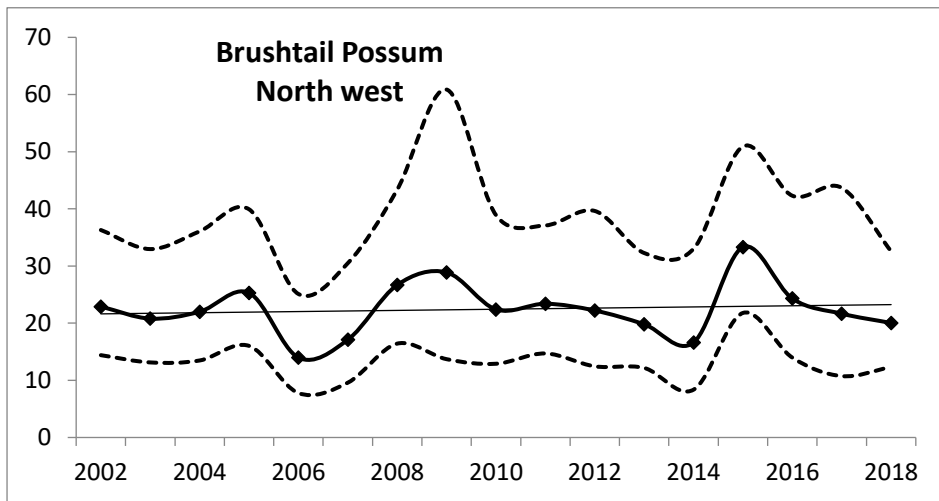
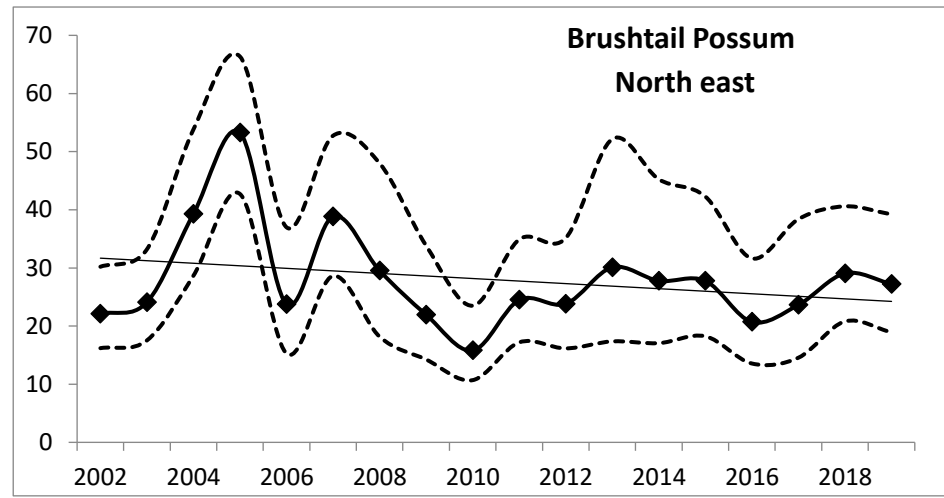
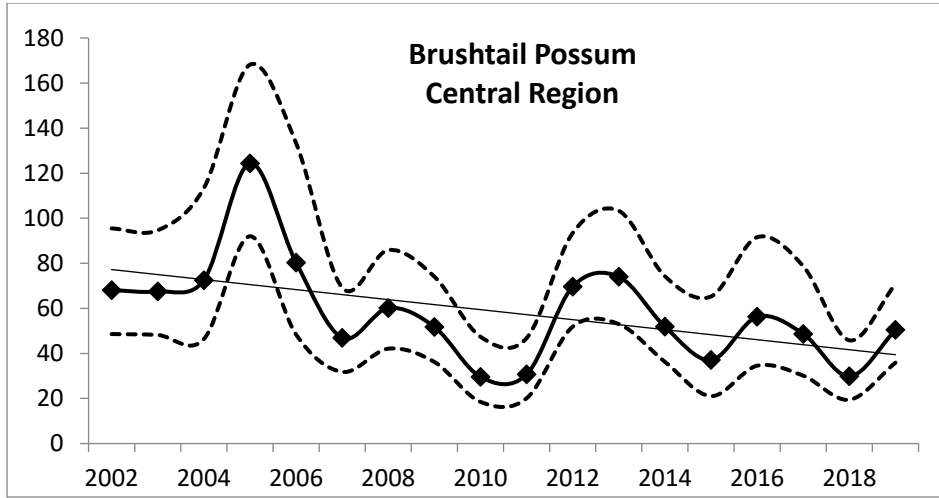
The results for 2019 surveys were mixed, with density estimates essentially stable in the North West, North East and South East. Estimates were up in the Central region but still depicting a downward trend since 2002. Density estimates were up in the South West and down on Flinders Island compared to recent years. The statewide average density index for brushtail possum in 2019 was 33.2 animals per square kilometre. The long-term average statewide density trend is shown in Appendix 1.

**Table 2: Regional Density Index Summary 2019: Brushtail Possum (BP)**

	Density (n/km <sup>2</sup> )	%CV	No. BPs	Length (km)	Enc. Rate (n/km)	Detection Probability
Central	50.4	17.2	298	270	1.10	0.109
Flinders Is.	6.4	82.4	21	80	0.26	0.205
King Island	-	-	-	-	-	-
North East	27.2	18.5	234	600	0.39	0.072
North West	21.5	16.0	98	290	0.33	0.079
South East	24.9	25.6	275	430	0.440.64	0.128
South West	41.8	40.8	66	120	0.55	0.066

**Table 3: Regional Density Index results 2010 – 2019: Brushtail Possum**

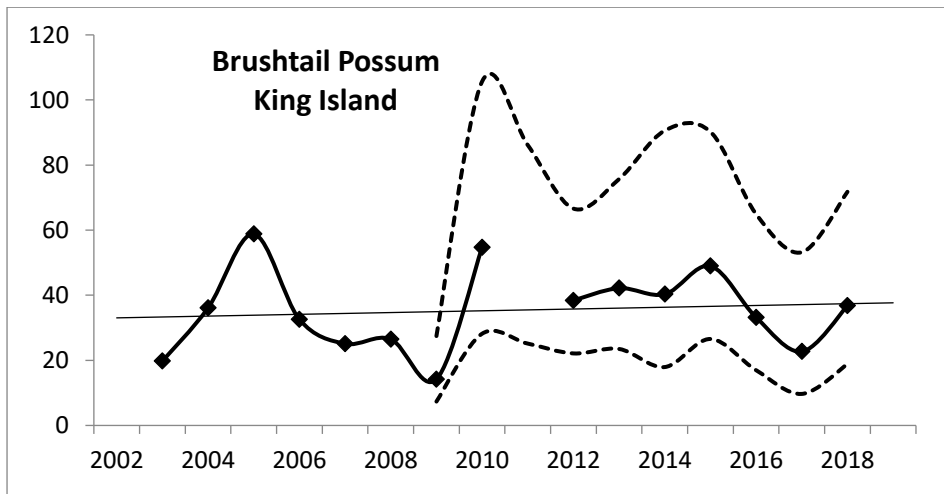
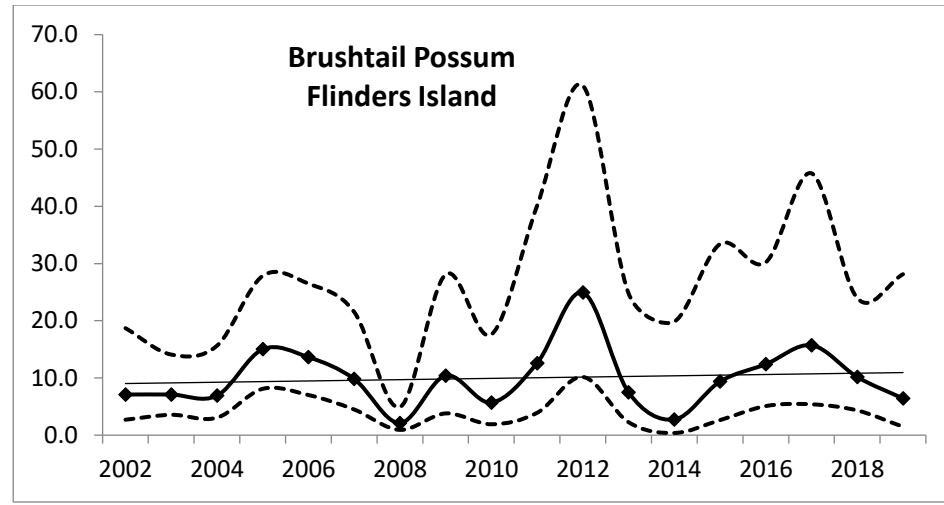
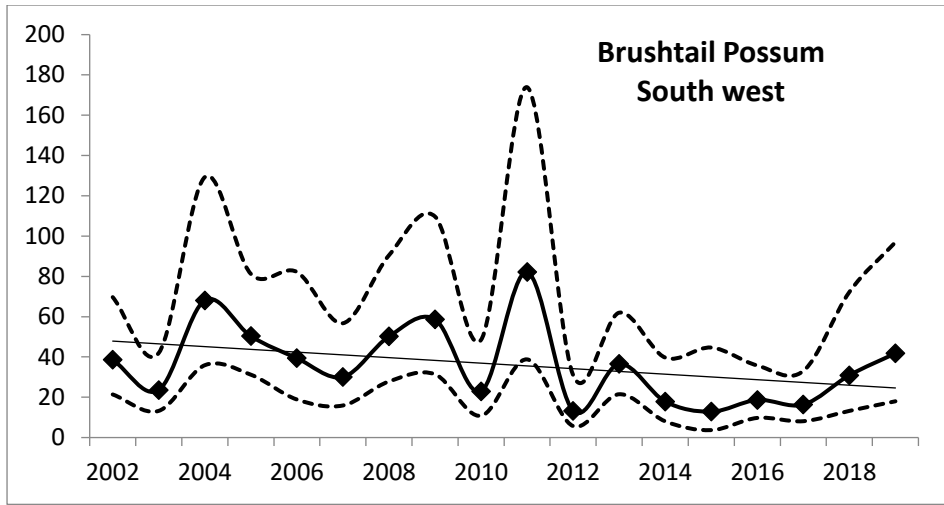
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Central	29.6	30.7	69.6	74.0	51.9	37.1	56.3	48.7	29.9	50.4
Flinders Is.	5.7	12.63	24.9	7.48	2.7	9.4	12.4	15.7	10.2	6.4
King Island	54.6	-	38.4	42.18	40.3	49.0	33.2	22.7	36.8	-
North East	15.8	24.5	23.8	30.1	27.8	27.8	20.7	23.6	29.1	27.2
North West	22.4	23.4	22.2	19.8	16.6	33.3	24.3	21.7	20.0	21.5
South East	17.2	36.8	38.4	34.8	23.1	31.1	13.7	28.8	21.6	24.9
South West	22.9	82.2	13.3	36.5	17.9	12.8	18.7	16.4	30.9	41.8



**Figure 1: Density index trends in each region – brushtail possums 2002-2019.**

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





**Figure I (continued): Density index trends in each region – brushtail possums 2002-2019.**

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

**Note:** Prior to 2009, King Island was managed and reported under a Wildlife Trade Operation plan which included different data analysis and reporting, consequently 95% confidence limits are not available for this period. Also, King Island was not surveyed in 2011 and 2019.

## Bennett's Wallaby

A summary of the 2019 regional density indexes for the Bennett's wallaby is given in Table 4. The regional density indexes from 2010 to 2019 are shown in Table 5; Figure 2 depicts trends in the density index for the period 2002 to 2019.

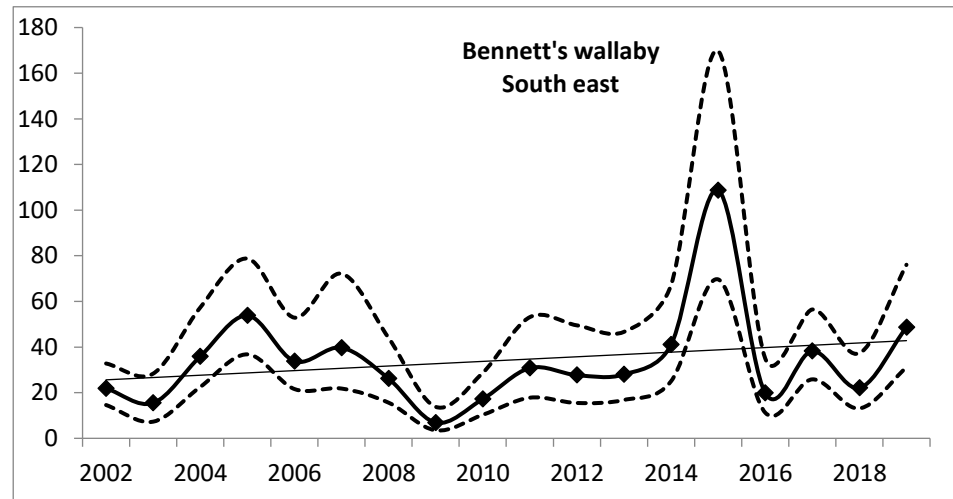
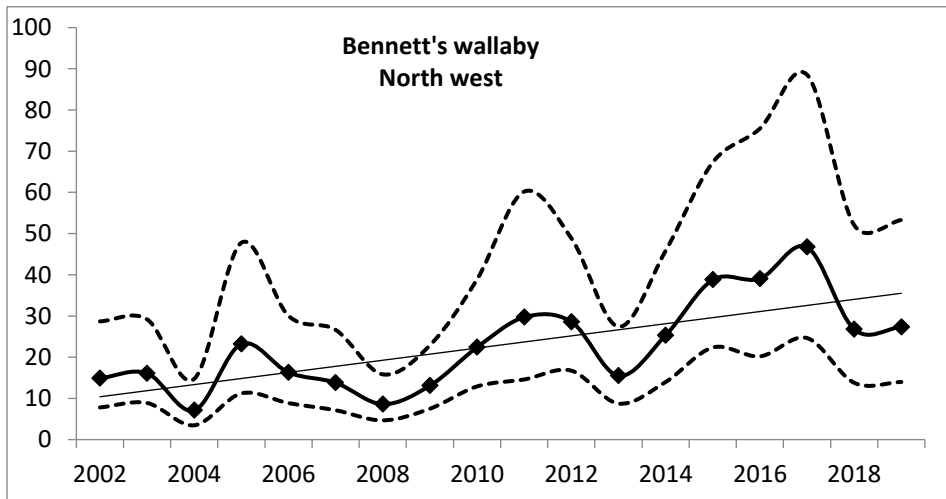
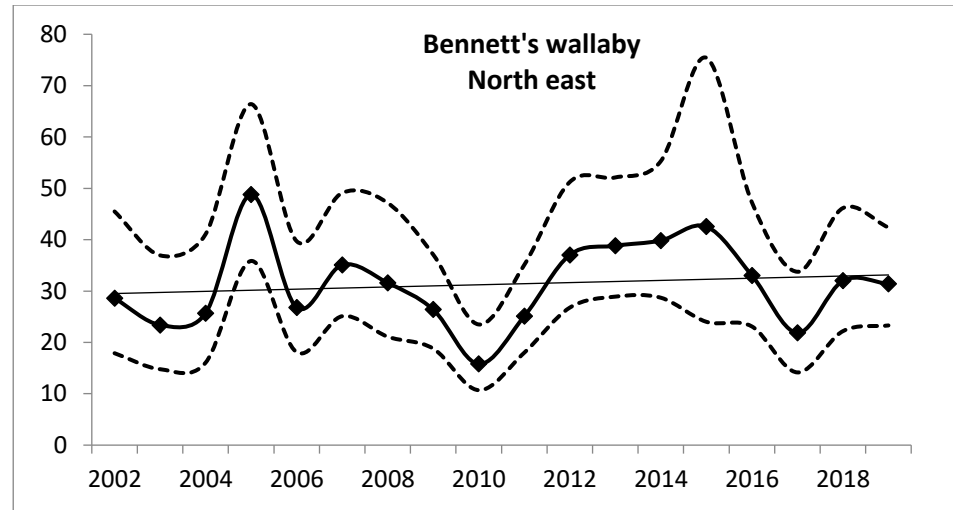
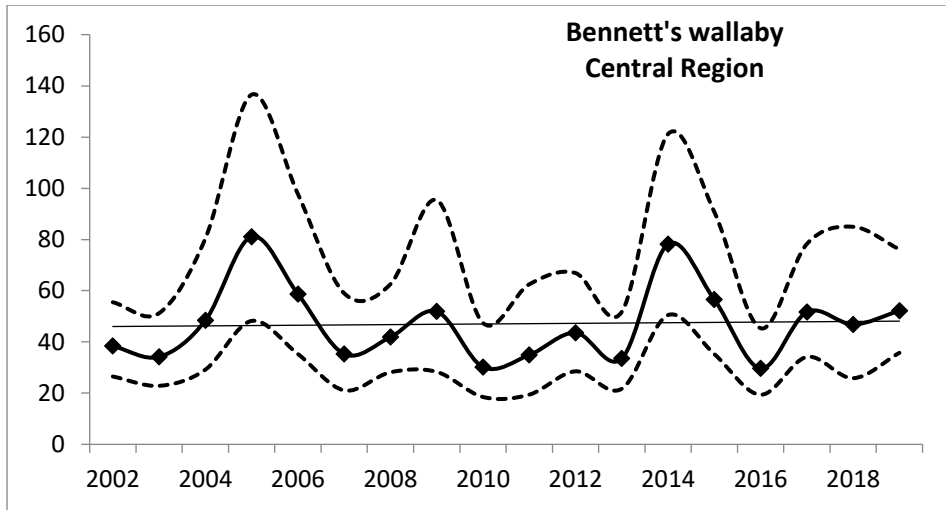
King and Flinders Islands typically have a significantly higher density of Bennett's wallaby than the rest of Tasmania, and this result continues for 2019 on Flinders Island. The South East region recorded an increase in density from 2018. The South West region also recorded an increase in density compared to 2018. The 2018 results for the South West were considered to be low due to the impacts caused by the Gell River fires. The Bennett's wallaby density for the North West, Central and North East regions remained stable. The statewide average density index in 2019 for Bennett's wallaby was 35.7 animals per square kilometre, in keeping with the long-term average statewide density trend (shown in Appendix 1).

**Table 4: Regional Density Index Summary 2019: Bennett's Wallaby**

	Density (n/km <sup>2</sup> )	%CV	No. BW's	Length (km)	Enc. Rate (n/km)	Detection Probability
Central	52.2	19.0	402	270	1.49	0.14
Flinders Is.	215.3	30.5	637	80	7.96	0.18
King Island	-	-	-	-	-	-
North East	31.4	15.2	425	600	0.71	0.11
North West	27.3	34.0	180	290	0.62	0.11
South East	48.7	22.8	753	430	1.75	0.18
South West	18.8	40.0	31	120	0.26	0.07

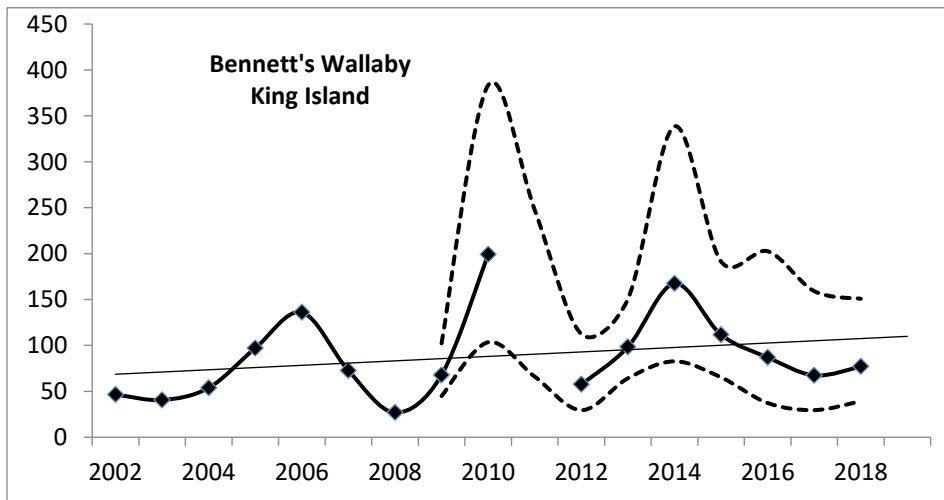
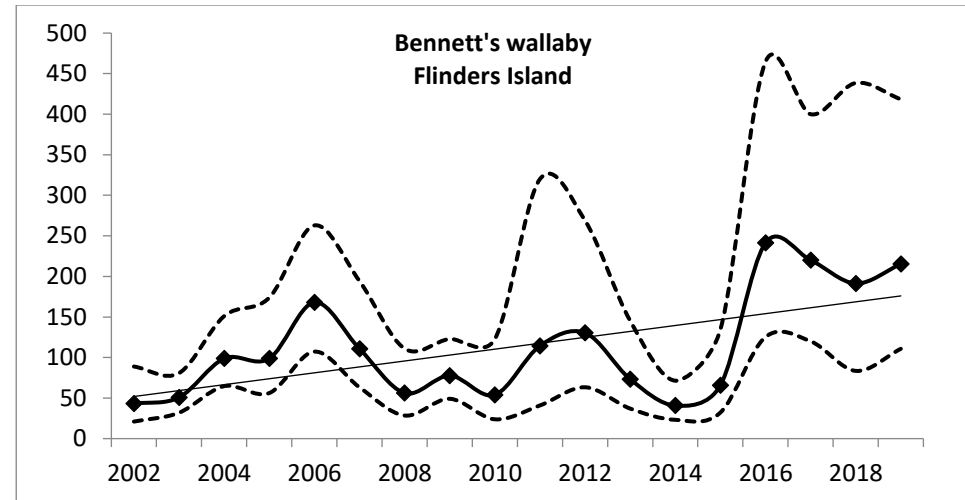
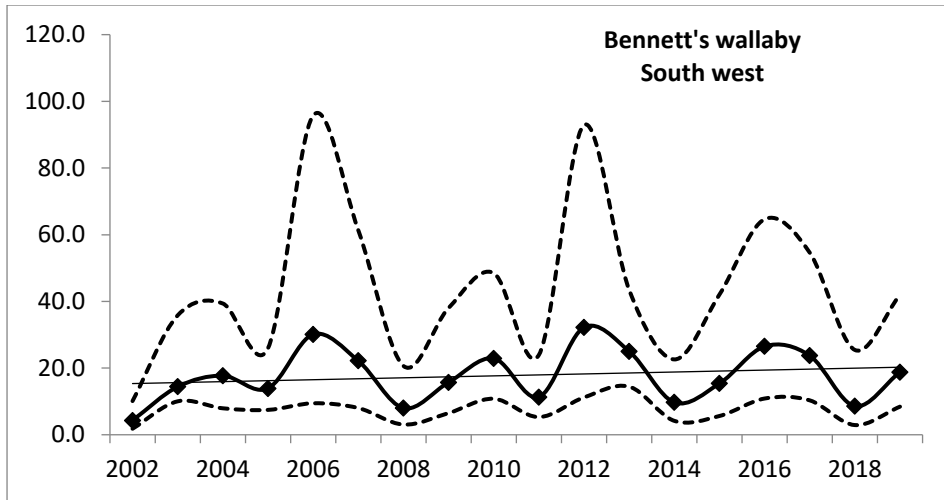
**Table 5: Regional Density Index results 2009 – 2019: Bennett's Wallaby**

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Central	30.2	34.9	43.6	33.5	78.2	56.5	29.6	51.7	46.9	52.2
Flinders Is.	54.1	114.4	130.4	73.4	40.7	65.8	241.3	220.0	191.3	215.3
King Island	199.2	-	57.5	98.3	167.3	111.7	87.0	68.6	77.0	-
North East	18.8	25.1	37.0	38.8	39.8	42.6	33.1	21.9	32.0	31.4
North West	10.1	29.7	28.6	15.5	25.3	38.8	39.1	46.7	26.9	27.3
South East	9.0	30.8	33.8	28.0	41.0	108.7	19.8	38.2	22.1	48.7
South West	15.0	11.3	32.2	25.1	9.7	15.4	26.5	23.7	8.6	18.8



**Figure 2: Density index trends in each region – Bennett’s wallaby 2002-2019.**

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 2002-2019.**

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

**Note:** King Island was managed and reported under a Wildlife Trade Operation plan which included different data analysis and reporting prior to 2009, consequently 95% confidence limits are not available for this period. Also, King Island was not surveyed in 2011 and 2019.

## Tasmanian Pademelon

A summary of the 2019 regional density indexes for Tasmanian pademelon is given in Table 6. The density indexes from 2010 to 2019 are given in Table 7 and Figure 3 depicts the density index for the period 2002 to 2019.

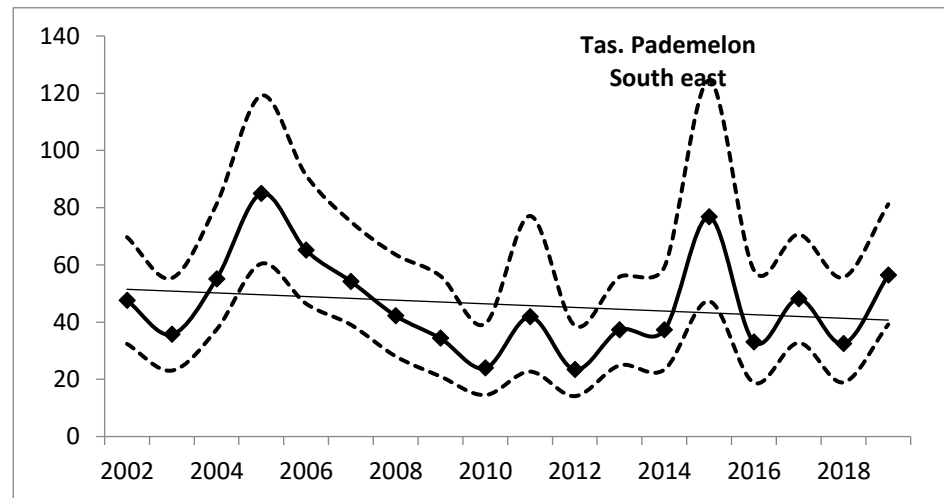
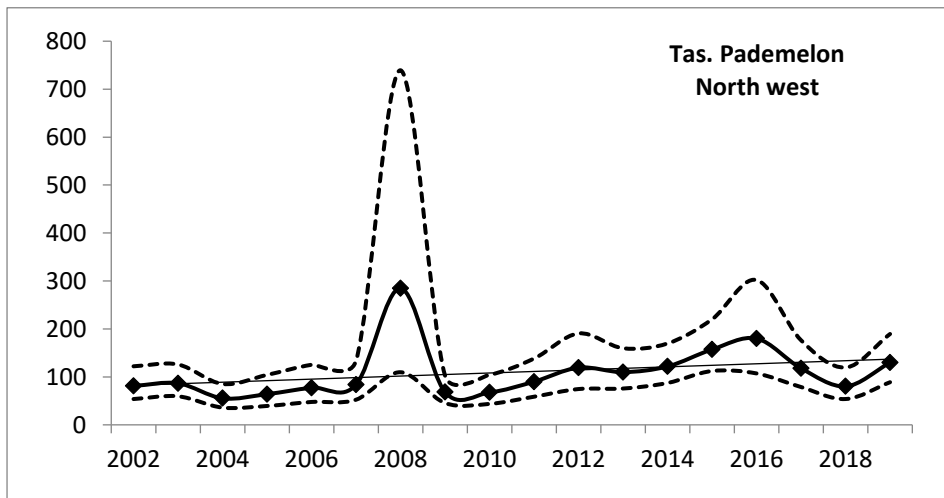
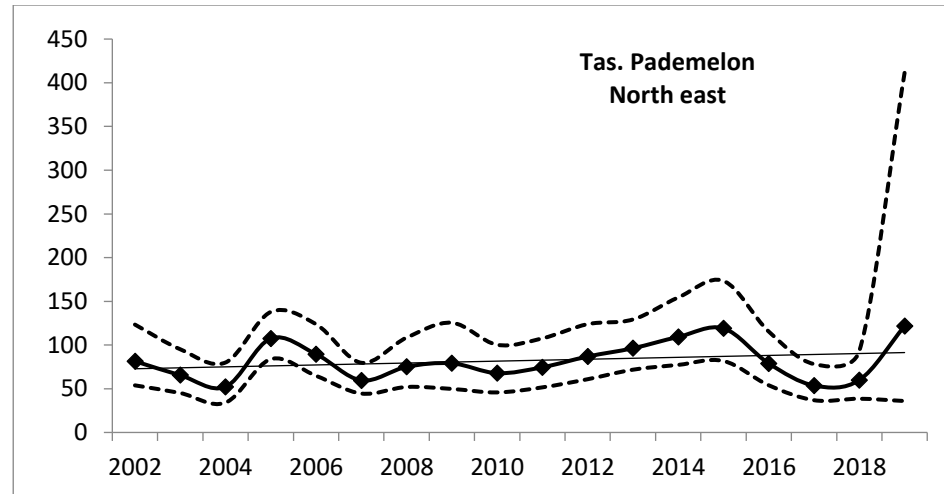
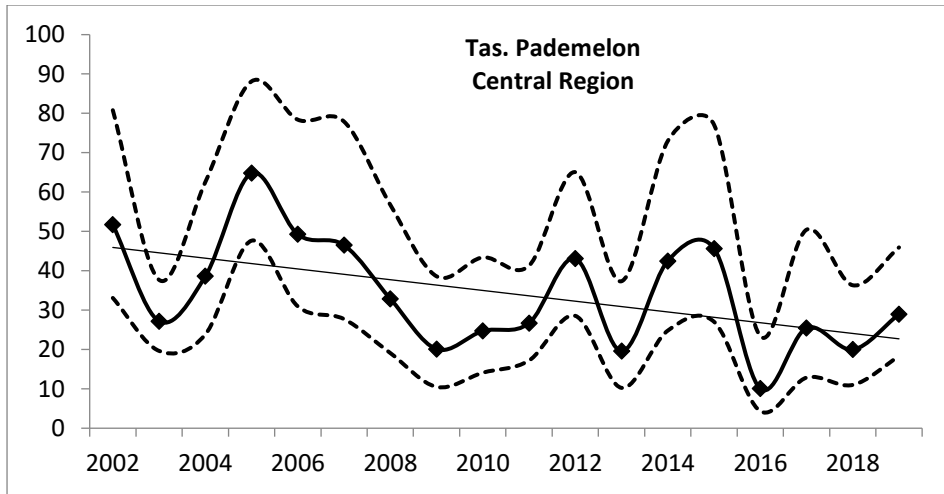
All regions recorded an increase in density since the 2018 surveys. As with the Bennett's wallaby, the density of Tasmanian pademelon in the South West region may have been lower in 2018 due to the impacts caused by the Gell River Fires. The statewide density index for Tasmanian pademelons in 2019 was 86.0 animals per square kilometre. This is higher than the long-term yet stable trend (shown in Appendix I).

**Table 6: Regional Density Index Summary 2019: Tasmanian pademelon**

	Density (n/km <sup>2</sup> )	%CV	No. TP's	Length (km)	Enc. Rate (n/km)	Detection Probability
Central	29.0	23.3	169	270	0.63	0.11
Flinders Is.	81.9	52.2	293	80	3.66	0.22
King Island	-	-	-	-	-	-
North East	121.7	68.6	1221	600	2.04	0.08
North West	129.7	18.9	769	290	2.65	0.10
South East	56.4	18.5	398670	430	1.56	0.14
South West	93.4	23.0	114	120	0.95	0.05

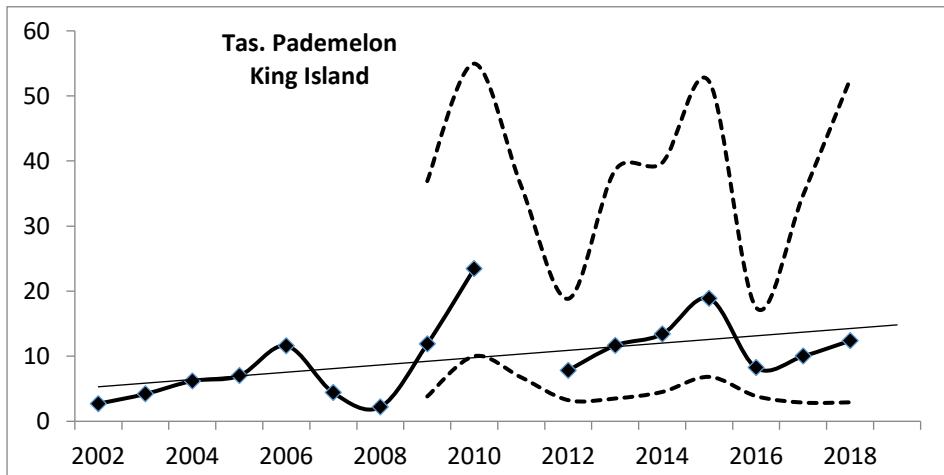
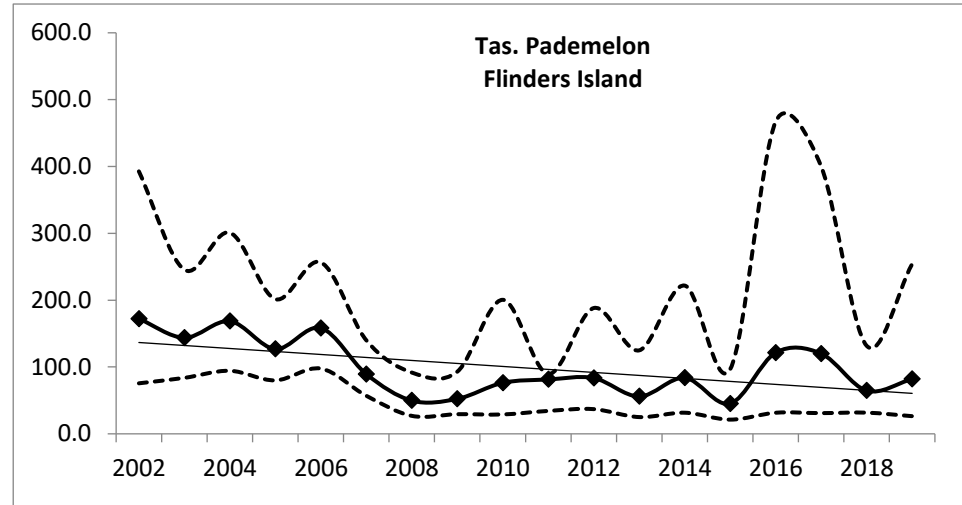
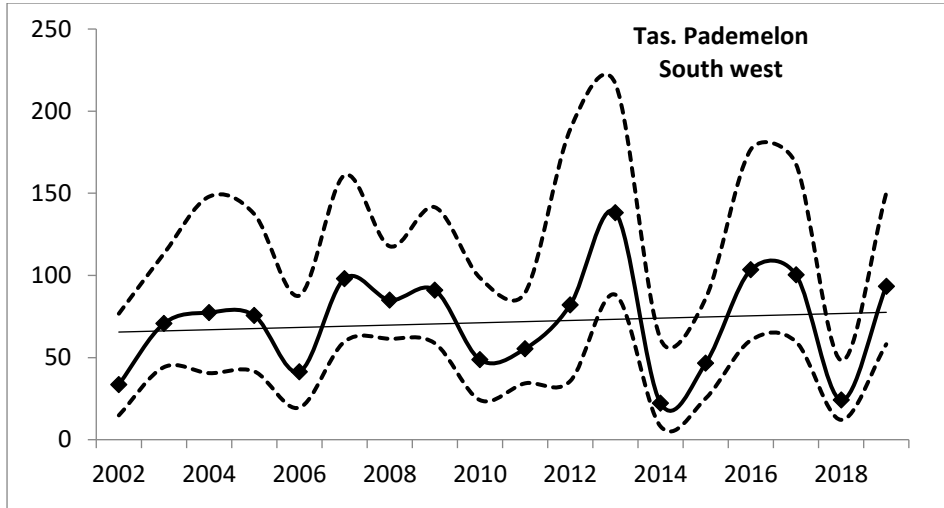
**Table 7: Regional Density Index results 2009 – 2019: Tasmanian pademelon**

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Central	24.7	26.7	43.1	19.6	42.5	45.7	10.54	25.5	20.0	29.0
Flinders Is.	76.3	81.3	83.4	55.9	83.7	45.4	121.5	120.0	64.6	81.9
King Island	23.5	-	7.8	11.6	13.4	18.9	8.2	10.0	12.4	-
North East	67.8	74.6	86.8	96.3	109.3	119.1	78.9	53.7	60.0	121.7
North West	67.5	90.0	119.3	110.0	121.8	157.2	180.0	117.9	80.2	129.7
South East	23.9	41.8	23.4	37.3	37.2	76.7	33.1	48.1	32.5	56.4
South West	48.7	55.4	82.1	138.3	22.2	46.5	103.4	100.0	24.1	93.4



**Figure 3: Density index trends in each region – Tasmanian pademelon 2002-2019.**

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



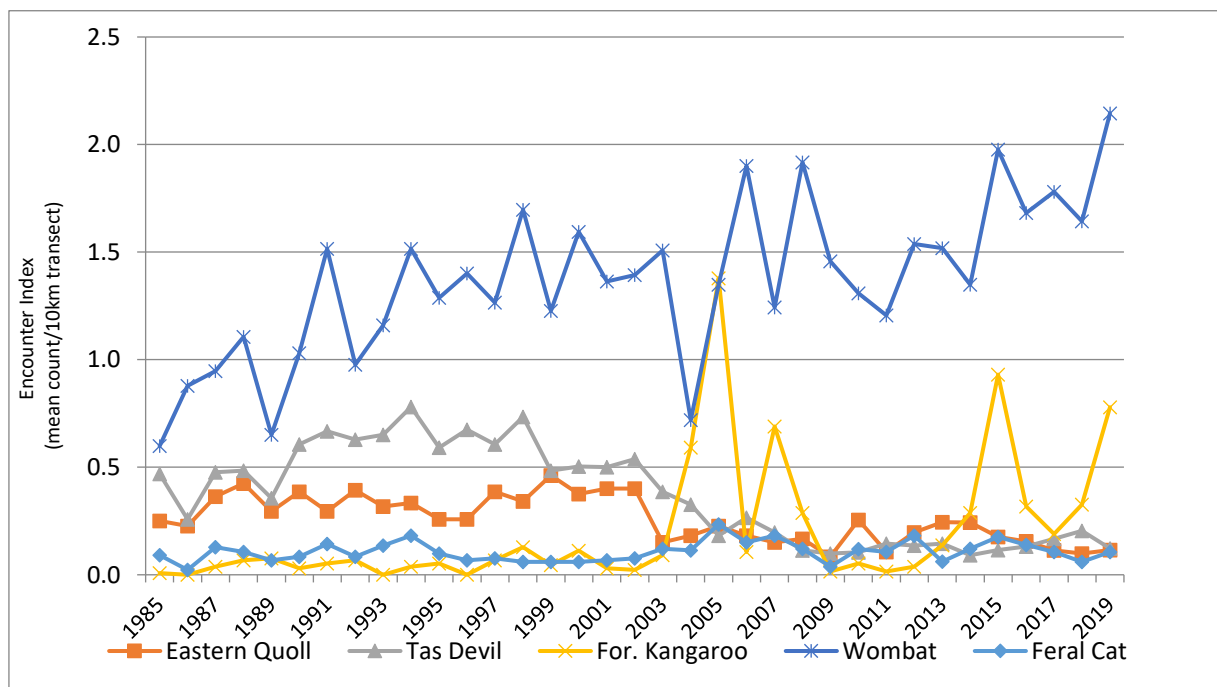
**Figure 3 (continued): Density index trends in each region – Tasmanian pademelon 2002-2019.**

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

**Note:** King Island was managed and reported under a Wildlife Trade Operation plan which included different data analysis and reporting prior to 2009, consequently 95% confidence limits are not available for this period. Also, King Island was not surveyed in 2011 and 2019.

## Non-harvested Species

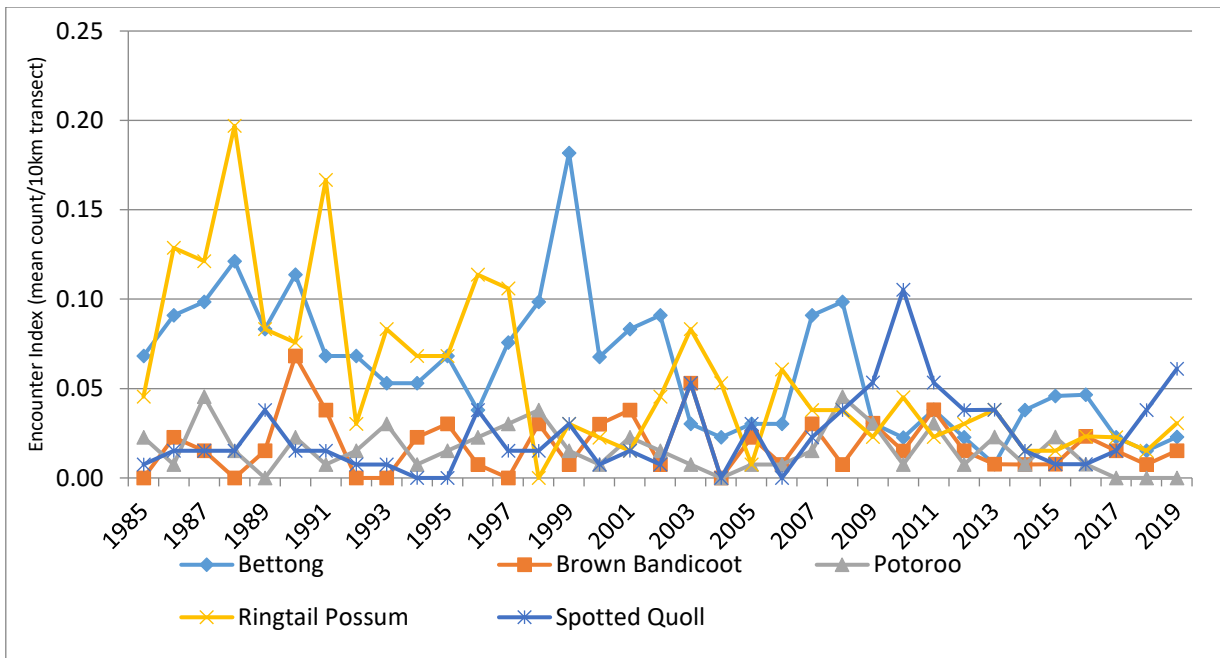
While the statewide spotlight surveys are designed specifically to monitor the three harvested species, the surveys also enable the collection of data for other species. As a consequence of the lower abundance and/or lower observability of these species, insufficient data is collected to allow density analysis to be undertaken. 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 I, 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 only the 132 transects done continuously since 1985





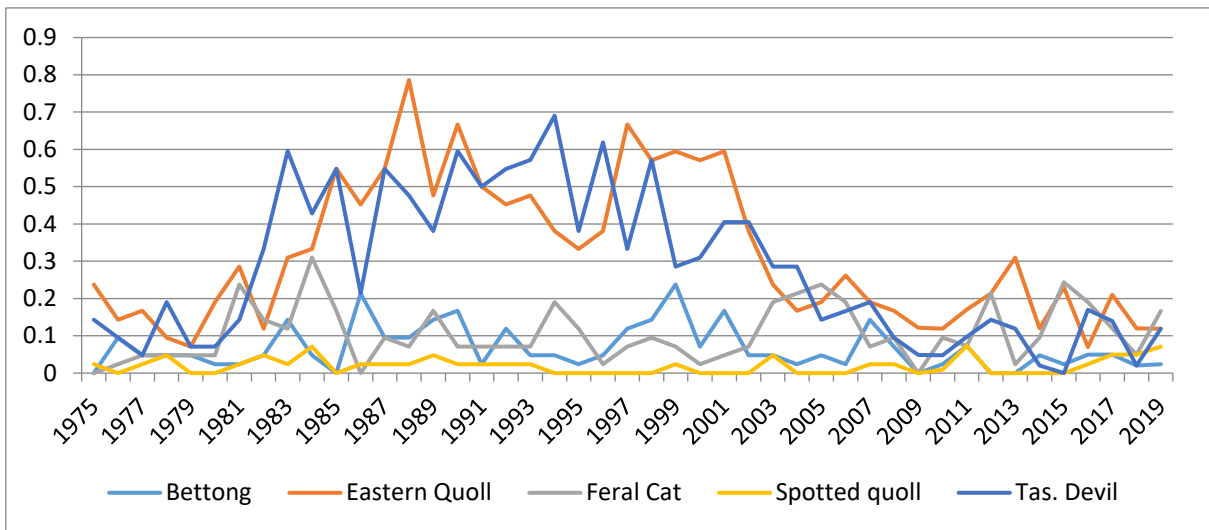
**Figure 5: Encounter rates for selected species on mainland Tasmania\* (Part 2)**

\*Based on only the 132 transects done 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.

This is particularly of interest given the declining trends, based on the 1985 data series, evident in several species (Tasmanian devil, eastern quoll, Tasmanian bettong). Based on the 1975 data series the trend for these three species is still negative but less pronounced. Trends in encounter rates based on the 1975 data series are provided in Figure 6.

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

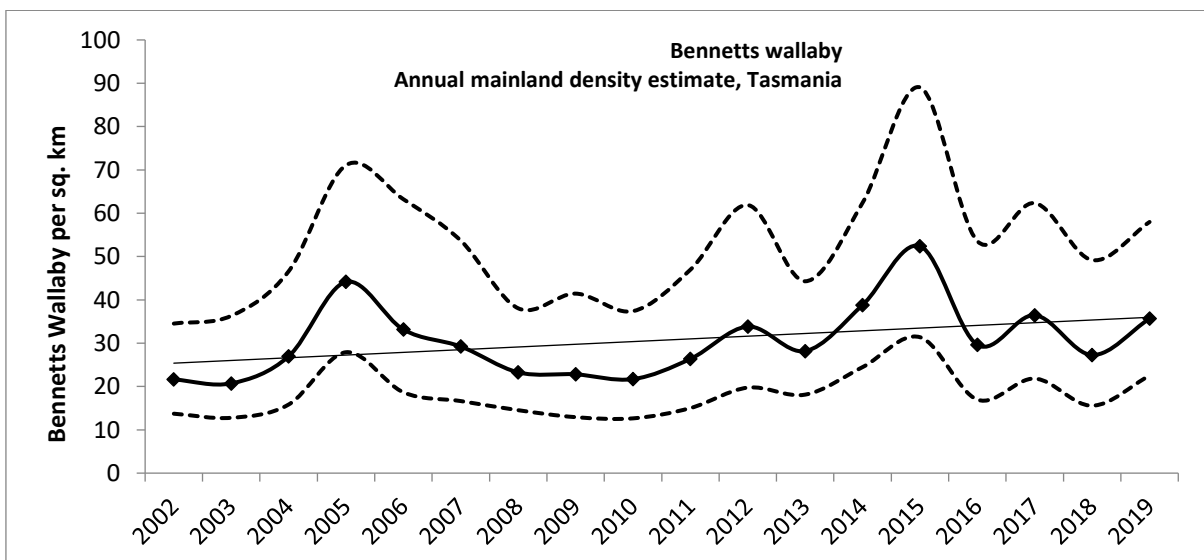
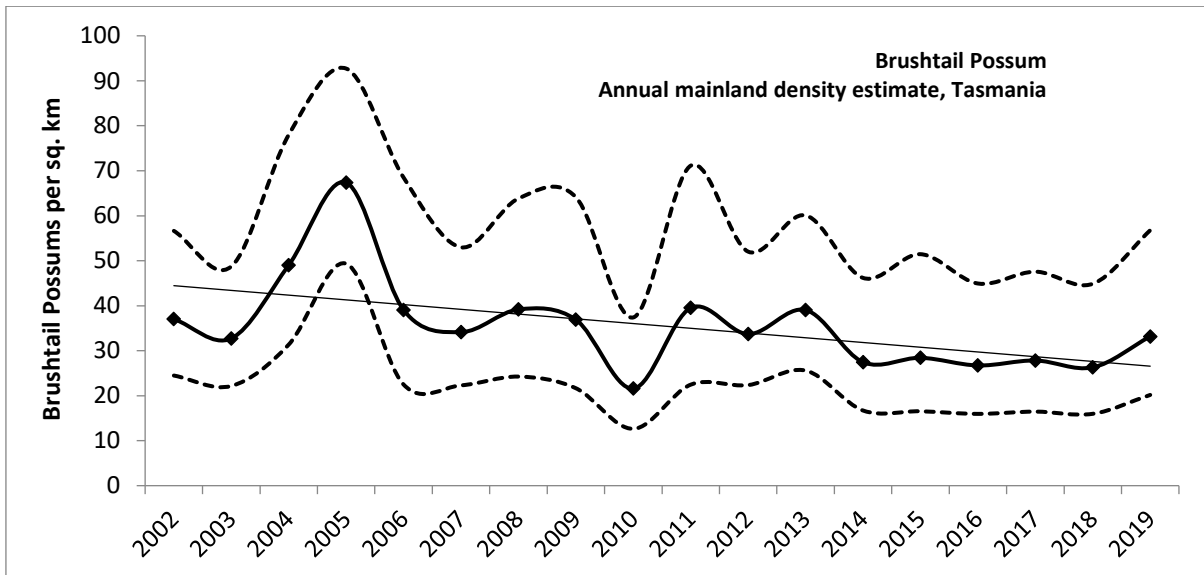


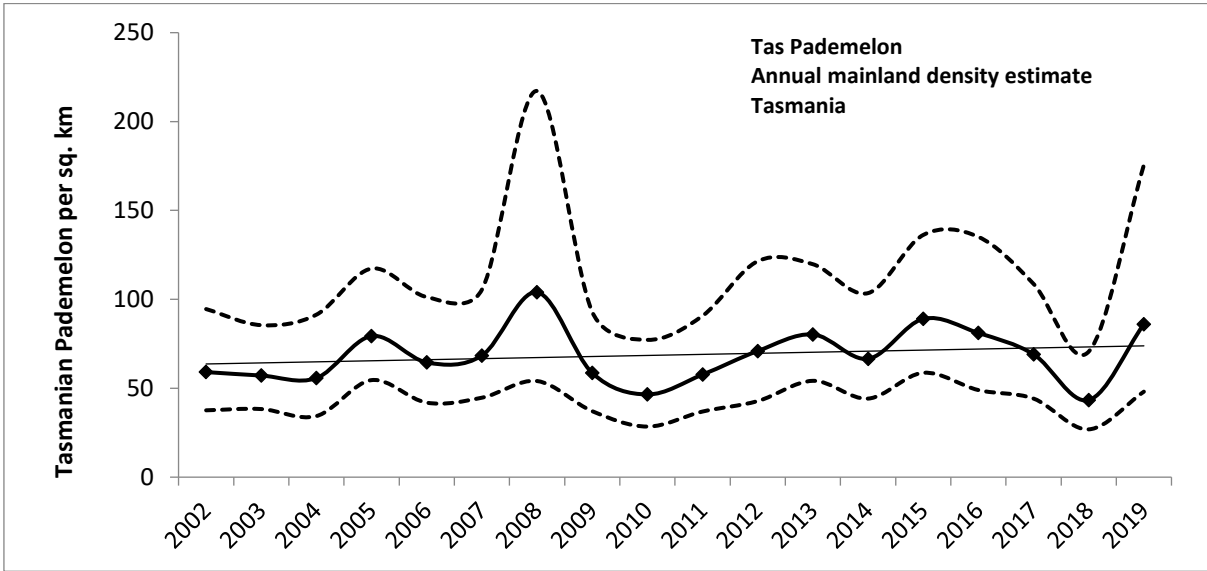
\*Based on the original 42 transects done continuously since 1975

Although it must be stressed that these data (1975 series) should be interpreted with caution. Trends of particular interest include the return of eastern quoll and Tasmanian devil encounter rates to levels similar to those observed in the 1970s, and the absence of a major change in feral cat encounter rates over the period 1975-2018, despite the considerable changes in the Tasmanian devil and eastern quoll encounter rates over the same period.

## 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 58 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 additional mammal species observed during the Annual Statewide Spotlight Surveys, mainland Tasmania 2002-2019.

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



**Table 2: Raw counts of additional mammal species observed during the Annual Statewide Spotlight Surveys, Flinders Island 2002-2019.**

<b>FLINDERS ISLAND</b>		<b>Count</b>			
<b>Year</b>	<b># Surveys</b>	<b>Common wombat</b>	<b>Ringtail possum</b>	<b>Long-nosed potoroo</b>	<b>Feral cat</b>
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

**Table 3: Raw counts of additional mammal species observed during the Annual Statewide Spotlight Surveys, KING ISLAND 2002-2019**

<b>KING ISLAND</b>		<b>Count</b>	
<b>Year</b>	<b># Surveys</b>	<b>Feral cat</b>	<b>Fallow deer</b>
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

## **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 km<sup>2</sup>)**

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 km<sup>2</sup>)**

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 km<sup>2</sup>)**

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 km<sup>2</sup>)**

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.

### **Northwest Region (9,949 km<sup>2</sup>)**

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.

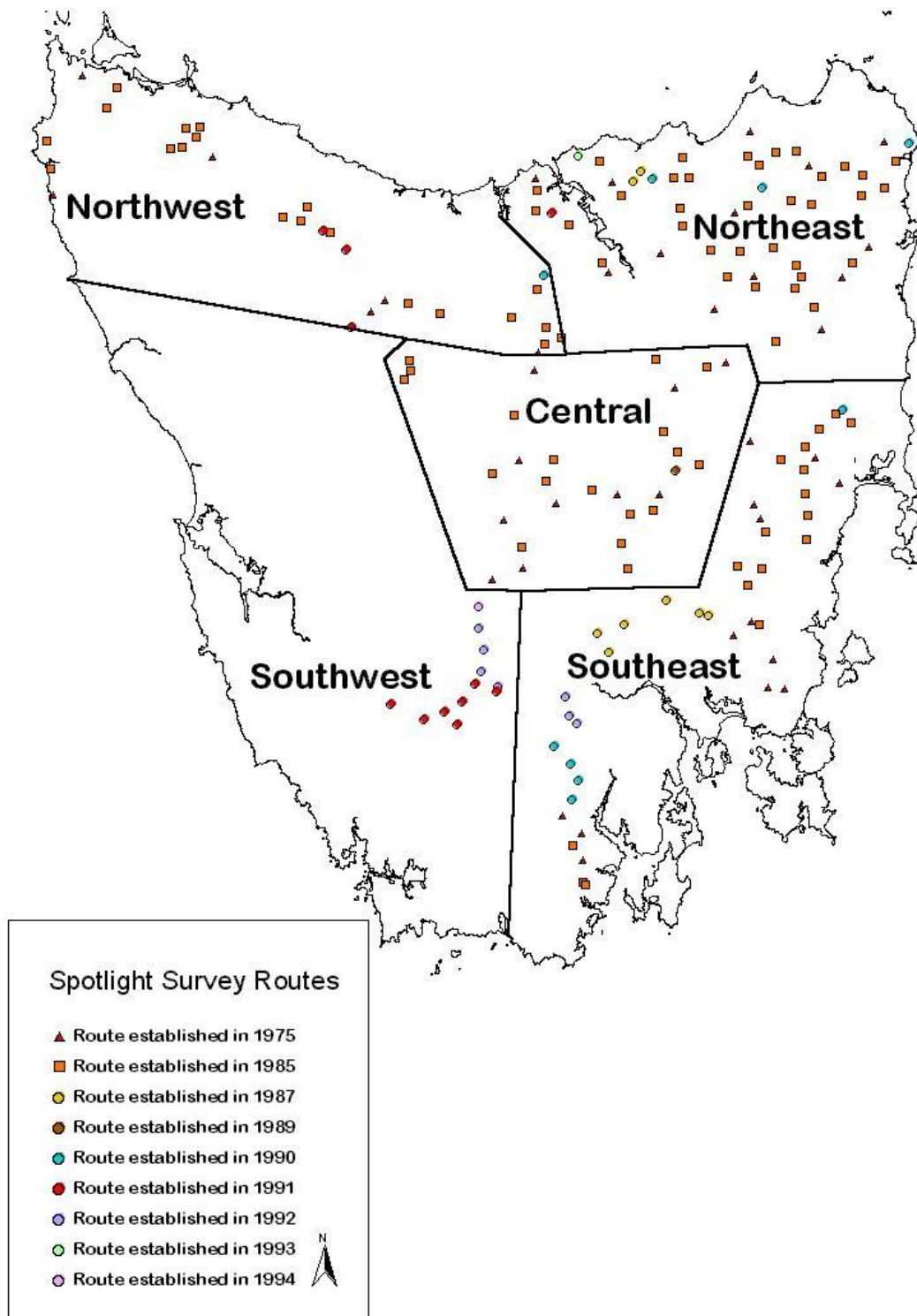
### **Flinders Island (1,333 km<sup>2</sup>)**

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 km<sup>2</sup>)**

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.





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