Chapter 2

STATISTICS RELATING TO CAUSES OF MORTALITY IN RED SQUIRRELS ON THE ISLE OF WIGHT

This short chapter covers general statistics not specifically related to pathology, which is discussed later. Sightings of dead red squirrels related in Part 3 were recorded between 1990 and 2021. Bodies collected between 1993 and 2021 were examined for gross pathology. Data has been analysed to look for trends in disease and other causes of mortality and morbidity in red squirrels on the Isle of Wight. Causes of mortality and morbidity are diverse with some animals presenting with more than one cause of pathology.

Detailed causes of death are discussed in the following chapters. The aim in this chapter is to give a broad view of statistics taken from the general sightings database plus statistics from the squirrels given a post mortem examination. Squirrels that had a post mortem are also recorded in the general sightings database and therefore included in these statistics. The reported death from 1990 came from a member of the public who responded to the 1991 newspaper article and remembered the road kill. As you would expect, the majority of carcasses are picked up from roads.

The general public report dead or sick red squirrels seen in their garden or when they are out and about. They also pick up sick, injured, young or dead squirrels. Live squirrels are treated and released if they recover. Those that die or are euthanised are examined.

Not all bodies are retrieved, particularly road casualties that are very badly damaged; however, they are added to the general sightings statistics. A small number of carcasses were presented for examination but far too damaged to glean useful data from.

Between 1993 and 2000, bodies were posted to the Zoological Society of London. Although a report was sent back to Wight Squirrel Project on the cause of death, no other details were given. These animals are included in the statistics.

When pathology is found, tissue samples are taken and fixed in 10% buffered formal saline solution or deep frozen until a laboratory can test them. Occasionally, a frozen carcass is either sent or, very rarely, delivered to a laboratory.

The animal's age is estimated by overall size, weight, teeth, shin length, reproductive status and observer's experience. The bodily condition of the animal was categorised as fat, normal, thin or emaciated. This status is determined through experience and therefore subjective.

The coat, eyes, mouth, skin and limbs are examined prior to opening the body to examine the organs. Once the body is opened to expose the internal organs, a careful examination is undertaken before cutting away the ribcage and severing connective tissue to extract the organs for individual examination. Findings are recorded on a pro forma sheet, a sample of which is shown in Appendix 1. From September 2014 onwards, pinna from dead red squirrels on the Isle of Wight have been saved for future use in disease or genetic studies. This is ongoing so that tissue is available for future studies.

Opening the body to expose the internal organs

Bodies are either frozen by the member of the general public who retrieves them, or picked up by Wight Squirrel Project. Bodies are generally frozen at –20 degrees Celsius; only 40% were autopsied fresh. General condition is estimated from experience. 'Body incomplete' is recorded when a scavenger has taken part of the carcass.

Autolysis is often a problem given the time lapse between the squirrel's death, picking the body up and deep freezing or examining it. In summer, bodies are rarely very fresh given that the ambient temperature is generally high on the Isle of Wight. An extreme example was a squirrel described as fresh by the member of the general public who picked it up, when it was full of maggots and smelled awful. This animal was not examined.

Autolysis is not always apparent from the smell, maggots or subcutaneous green tinge. If samples are taken and sent away and autolysis found, then it may not be possible to give a conclusive cause of death, which is very disappointing all round.

General condition	Number
Body incomplete	4
Decomposing	1 0
Emaciated	39
Fat	51
Normal	544
Thin	123
Unrecorded	32
TOTAL	794

Condition	Number
Fresh	320
Frozen	450
Refrigerated	12
Decomposed	9
Unrecorded	3
TOTAL	794

Overall statistics

Graphs visually illustrate statistics. These tables and graphs are taken from the post mortem database of 794 red squirrels.

Data analysis shows that the male to female ratio of red squirrels presented for post mortem examination was 49% per gender with 2% unrecorded. Unrecorded entries pertain to the animals where the body is incomplete or too damaged for positive identification of gender.

Ggender and age breakdown

Gender	Number	%
Male	390	49%
Female	387	49%
Unrecorded	17	2%
TOTAL	794	

Gender	Number	%
Adult	525	66%
Sub-adult	154	19%
Juvenile	101	13%
Unrecorded	14	2%
TOTAL	794	

A breakdown of age statistics shows that two-thirds of submitted bodies are adults. Younger animals are generally found in gardens whereas the majority of road kills, the most often retrieved carcasses, are adults.

Road kill breakdown	
191 females	26 were under one year old
225 males	45 were under one year old

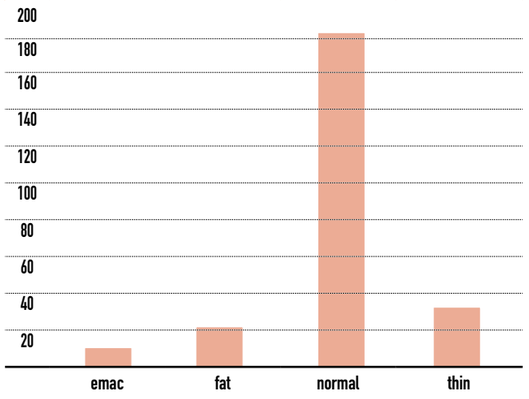
The following graphs show that the majority of animals presented in normal body condition.

None of the juvenile males were judged to be fat and only one female juvenile was regarded as fat.

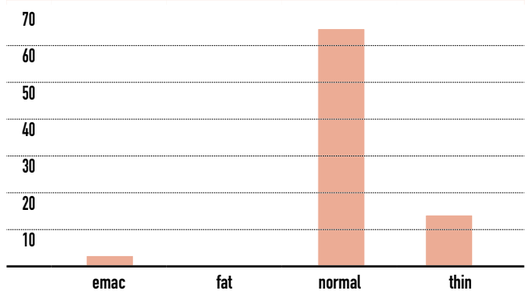
A total of 54 cases are unrecorded.

Condition of animal by age and gender: male

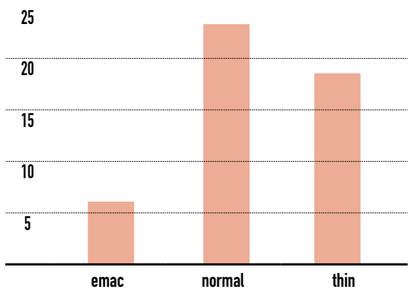
Adult male n=249



Sub-adult male n=79

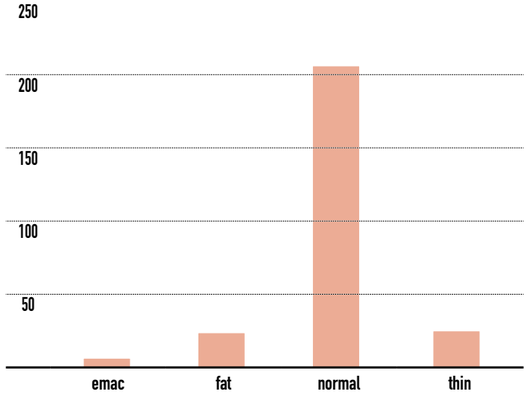


Juvenile male n=47

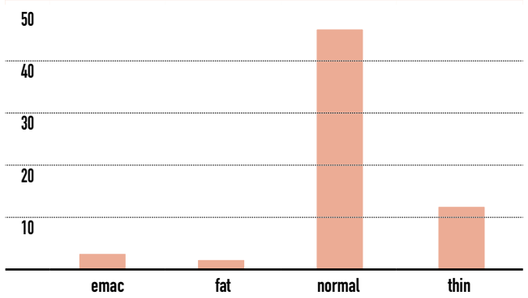


Condition of animal by age and gender: female

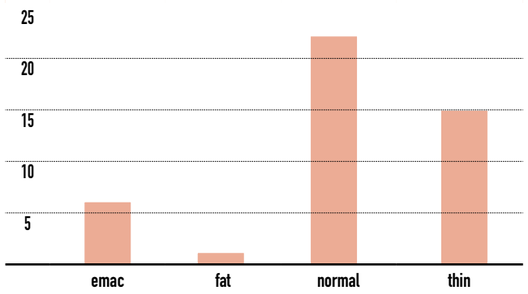
Adult female n=258



Sub-adult female n=63



Juvenile female n=44



Weight and shin length

Weight

Gender	Number sampled
Adult males	249
Adult females	252
Sub-adult males	80
Sub-adult females	65
Juvenile males	49
Juvenile females	51
Unrecorded	48
TOTAL	794

Shin length

Gender	Number sampled
Adult males	201
Adult females	212
Sub-adult males	57
Sub-adult females	59
Juvenile males	43
Juvenile females	45
Unrecorded	177
TOTAL	794

Males: n=388 Females: n=383

Sample numbers differ as not all measurements were recorded for every animal brought in.

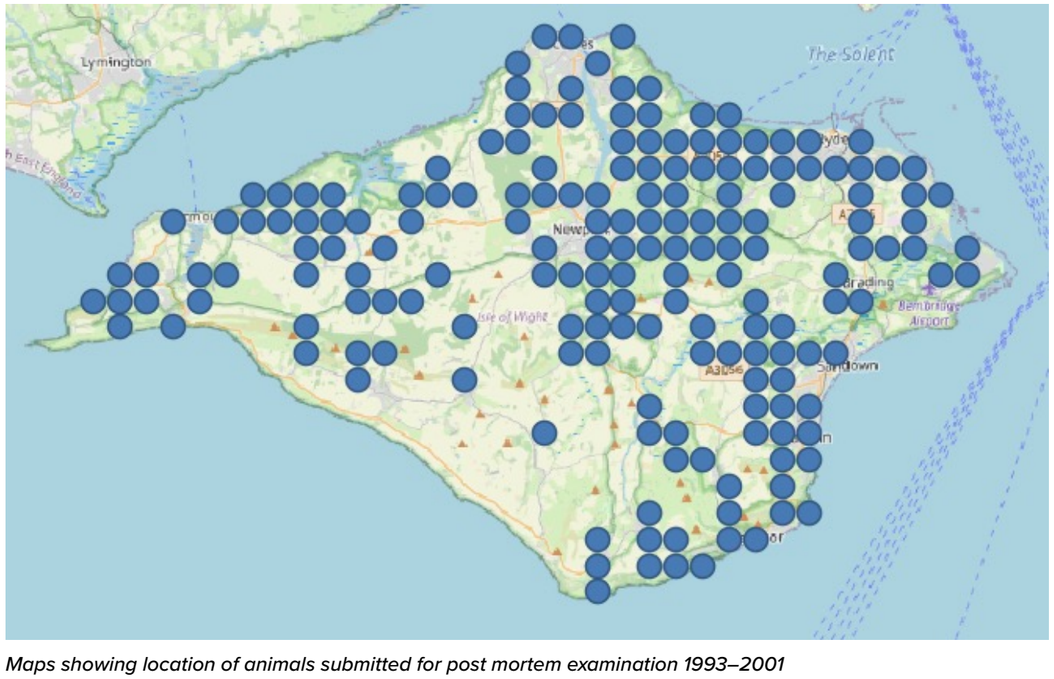
Age/ gender	Shin length (mean) (mm)	Range (mm)
Adult male	70.78	60–81
Adult female	70.89	55–81
Sub-adult male	66.72	53–72.5
Sub-adult female	66.66	51–72
Juvenile male	56.63	36–70
Juvenile female	58.12	36–69

Age	Median weight (grams)	Range
Adult male	305.48	200–435
Adult female	300.63	172–405
Sub-adult male	244.04	152–310
Sub-adult female	229.72	152–310
Juvenile male	120.79	49–237
Juvenile female	186.72	66–220

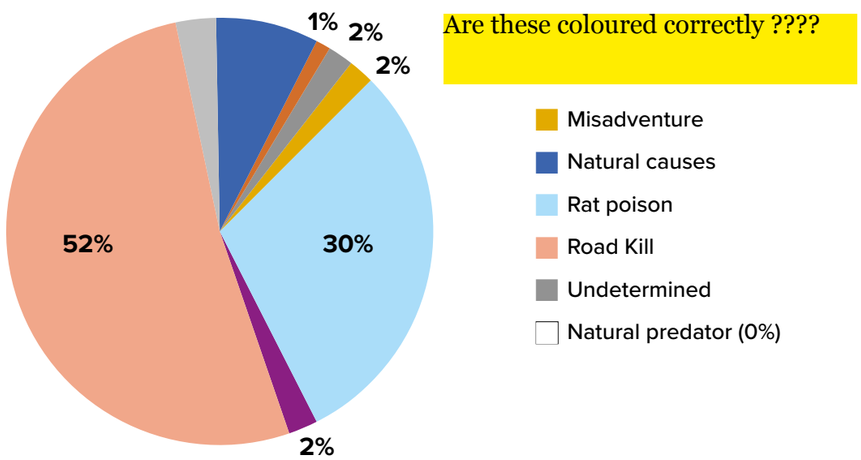
Table showing average weights from all conditions: emaciated to fat, pregnant and lactating. A juvenile is a squirrel judged to be 14 weeks or under; that is, until it has been weaned and left the family. A sub-adult is up to a year old

Location of death breakdown

The map shows the location of all red squirrels submitted for post mortem examination. The pattern broadly fits the maps showing where squirrels are sighted. That is, where humans live and the busiest roads are.



Maps showing location of animals submitted for post mortem examination 1993–2001



Breakdown of cause of death for all red squirrels presented for post mortem examination given as a percentage

Age breakdown relating to cause of death
Note: Ages are not always recorded

Juveniles

Cause of death	Number	%
Cat kill	22	15%
Dog	2	1%
Euthanasia	6	4.5%
Natural causes	48	33%
Rat poison	1	0.5%
RTA	65	44%
Undetermined	3	2%
Total	147	

Sub-adults

Cause of death	Number	%
Cat kill	22	21%
Euthanasia	2	2%
Misadventure	1	1%
Natural causes	69	65%
RTA	4	4%
Undetermined	8	7%
Total	106	

Adults

Cause of death	Number	%
Cat kill	19	4%
Dog kill	4	1%
Euthanasia	5	1%
Natural causes	107	20%
Unidentified predator	4	1%
Rat poison	11	2%
RTA	347	68%
Undetermined	15	3%
Total	512	

Where ‘natural causes’ is given as cause of death, it relates to any pathology not directly caused by human activities. The term as used in these tables, include starvation and old age for example. The diverse range of pathology and causes of death due to anthropogenic activities are discussed in later chapters.

PART 3. CHAPTER 2

Appendix 1. Pro forma sheet completed during post mortem examination

Necropsy Sheet - Table 1

Clinical Reference number .....
Pathology Reference number .....

Name of species ..... Scientific name .....
Age ..... Sex .....
Identity number (ring etc.) ..... Pet name .....
Owner's name ..... Veterinarian's name .....
Owner's address..... Veterinarian's address.....
....
....
....
Date of death ..... Date of necropsy .....

Post mortem* findings

Body weight .....
Physical condition
Normal ---❑ Fat---❑ Thin --❑ Emaciated ----❑ Other--❑ .....
State of carcase
Fresh ---❑ Refrigerated -----❑ Deep frozen--❑ Decomposed----❑ Incomplete----❑
Systems

1. Skin/appendages ----------NLD ❑ NE ❑
2. Skeletal ----------NLD ❑ NE ❑
3. Sensory ----------NLD ❑ NE ❑
4. Muscular ----------NLD ❑ NE ❑
5. Respiratory ----------NLD ❑ NE ❑
6. Cardiovascular ----------NLD ❑ NE ❑
7. Endocrine ----------NLD ❑ NE ❑
8. Liver ----------NLD ❑ NE ❑
9. Digestive ----------NLD ❑ NE ❑
10. Lymphoreticular ----------NLD ❑ NE ❑
11. Urinary ----------NLD ❑ NE ❑
12. Reproductive ----------NLD ❑ NE ❑
13. Nervous ----------NLD ❑ NE ❑

***Post mortem* findings / lesions** .....
.....
.....
.....
.....
.....
.....
.....
.....
..... (continue over).

Diagnosis (provisional ❑ / final ❑) .....
.....
.....

* Tick boxes and describe in the space provided. Under "Systems", if no lesions of skin/appendages *etc.* are detected tick "NLD" box. If a system is not examined tick "NE" box. When lesions are found use the number given for the system and describe in the space beneath "*Post mortem* findings / lesions", continuing on back of sheet if necessary.