# The utilisation of carcasses by *Lucilia cuprina* (Wiedemann) as a breeding site in Tasmania

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**Summary**

*Lucilia cuprina successfully reproduced from all five carcasses of sheep suffering fly-strike at the time of death, and accounted on average for 4.0% (mean 127 ± 44 flies per carcass) of the adult fly-strike population from these carcasses. In contrast, L. cuprina emerged from only seven of eighteen brushtail possum carcasses. At Richmond, L. cuprina emerged from five possums representing on average 0.7% (range 1-6 flies per carcass) of the emergent fly-strike population. In addition, L. cuprina successfully reproduced in two possums at Gladstone (4 and 7 flies per carcass) accounting for 0.4% of the emergent fly-strike population. The season when possum carcasses were exposed affected the number of adult flies emerging from carcasses, with more L. sericata emerging from carcasses exposed in autumn than in summer. During summer, temperatures in fly-struck possum carcasses reached 51.9°C or 15.2°C above ambient. Despite these temperatures exceeding the presumed thermal tolerance of L. cuprina, small numbers of this species still emerged from some of these carcasses. In the absence of strike on live sheep, carcasses may provide a sufficient resource for sustaining small local populations of L. cuprina. However, for L. sericata, Calliphora stygia and Chrysomya rufifacies possum carcasses provide a significant breeding resource. Therefore, when considering fly-strike management carcasses may need to be treated in such a way as to remove this resource for fly breeding.*

**Keywords**

Carrion, possum, sheep, *Chrysomya rufifacies, Calliphora stygia*, *Lucilia sericata*.

## Introduction

Few, if any *Lucilia cuprina* have been found to develop into adults from vertebrate carcasses in the semi-arid and arid regions of mainland Australia (O'Sullivan *et al*., 1983; Anderson *et al*., 1988; Cook *et al*., 1995). Similarly, in the cool temperate environments of mainland Australia, *L. cuprina* was found to represent less than 2.4% of the total fly population to successfully reproduce from carcasses (Waterhouse, 1947; Barton 1982; Monzu *et al*., 1984). As a consequence, carrion is generally considered an unsuitable breeding site for *L. cuprina*. However, factors that severely limit the reproductive success of *L. cuprina* from carrion in mainland Australia differ in the Tasmanian environment. The larvae of the secondary fly *Chrysomya rufifacies*, considered the main predator of *L. cuprina* in carcasses (Anderson and Simpson, 1991), have not been recorded in the south of Tasmania and are considered "non-persistent" in northern Tasmania (McQuillan *et al*., 1983). Furthermore, laboratory studies by Williams and Richardson (1984) on the thermal time and development of the major necrophagous fly species in Tasmania, *L. cuprina*, *Calliphora stygia*, *C. hilli* and *C. vicina*, suggest that *L. cuprina* larvae should be successful competitors in carcasses that have temperatures elevated above 30°C. Therefore, the underlying mechanisms for the poor performance of *L. cuprina* in carcasses in mainland Australia may not apply, especially in southern Tasmania, and suggests the possibility of carrion providing a significant resource for the maintenance of *L. cuprina* populations in Tasmania.

The present study examined the reproductive success of *L. cuprina* from brushtail possum (*Trichosurus vulpecular*) carcasses and from carcasses of sheep with fly-strike at the time of death. Both forms of carcass represent a large potential breeding resource for fly-strike species in Tasmania.

## Methods

### *Sheep carcasses*

Carcasses were selected from one sheep property in the northeast of Tasmania (Gladstone, 40°55'S). Criteria for carcass selection included death by natural causes of the animal within the previous 24 hours, the presence of overt fly-strike to the breech prior to death, and homogeneity between sheep grazing land at which carcasses were sited. Five merino ewe carcasses were selected, with one carcass per site. Prior to death, the animals were 4 years of age. The study was conducted from February to April 2000.

At each site, the position and location of the carcass was not altered. To prevent removal of the carcass from the site by carrion feeders, steel pins pegged through the legs secured the carcass to the ground. To prevent the loss of wandering larvae, a square aluminium "larvae fence" was erected around the carcass. Each side of the larvae fence was 160cm in length, 10cm high with a 3cm inward facing rim at the top of the fence and perpendicular to the fence sides. The larvae fence was positioned such that the body of the carcass was approximately equidistant to each fence side. Carcasses were enclosed within an insect emergence net within 7 days of sheep death. Insect emergence nets were sealed around the larvae fence base, and to a circular 3.2L clear plastic fly-trap container positioned 1m above ground level. Fly-traps were emptied weekly.

***Possum carcasses***

One sheep property was selected from the north east (Gladstone), central midlands (Campbell Town, $41^{o}55$'S), and south (Kempton, $42^{o}32$'S) of Tasmania. Three sites at each property were chosen from the most homogeneous sheep grazing land available to maintain intra and inter-site uniformity. Nine possum carcasses were provided from a location independent of the sheep properties. Possums were culled by a single gunshot wound to the head, and were stored overnight in airtight plastic bags immediately after culling. Selected carcasses had mean weights of $3.6 \pm 0.2$ kg, and were positioned at each site within 12 hours of death. The study was conducted between January and March 2000.

At each site, three possum carcasses were each placed on 10cm of sieved coarse sand in polystyrene packaging boxes, or possum boxes, measuring 55cm in length, 36.5cm width and 21cm depth. To allow rainwater drainage, four 1cm diameter holes covered with aluminium insect mesh were positioned in the base of each possum box. To prevent the loss of wandering stage larvae, a 3cm inward facing rim was located at the top and perpendicular to the possum box sides. Pit-fall traps were positioned in opposing corners of the possum box to monitor wandering larvae and predatory insect species. To prevent predation and interference from carrion feeding avian and vertebrate species, protective cages were then placed over the possum boxes.

The attractiveness of adult fly species to wind orientated fly-traps was monitored at each site within 24 hours of setting out each carcass. Fly-traps were located within 1m of the possum box and at 200m distances in north, south, west and east directions. Trap heights were standardised to 1m above ground level. Fly-trap baits contained 25g of minced sheep liver, 50mL of cattle dung (frozen for 2 weeks prior to bait preparation) and 1.5% w/v sodium sulphide solution. Carcass attractiveness was monitored for a 12 hour period from 0700 Eastern Standard Time.

Temperature data loggers (Tinytalk *ultra*: Gemini Data Loggers) were placed at one carcass site in each region to monitor ambient and carcass core temperatures. To record core temperatures, temperature probes were placed 5cm into the possum carcass chest cavity. Ambient temperature data loggers were sheltered from direct sunlight in free air movement, positioned 1m above ground level in upturned 5L white plastic containers. Both ambient and possum core temperatures were recorded at 1 hour intervals.

Possum cages were not enclosed with insect emergence nets until *L. cuprina's* predicted larval wandering stage, calculated at 12 days after possum placement in the field using Williams' (1981) *L. cuprina* larval development model. Mean ambient temperatures for the model were derived from the previous 5 years data obtained from Bureau of Meteorology recording stations.

Insect emergence nets were sealed around the possum box base, and to a circular 3.2L clear plastic fly-trap container positioned 1m above ground level. Fly-traps were emptied weekly.

Immediately prior to possum carcass enclosure, sub-samples of larvae from the carcass were randomly selected. Larvae were returned to the laboratory and reared on sheep liver at $20^{o}$C until pupation and subsequent emergence.

***Possum carcasses: exclusion experiment***

This experiment aimed to examine the reproductive success of *L. cuprina* from carcasses without the presence of *Ch. rufifacies.* Consequently a site in the south of Tasmania (Richmond, 42°44'S) where *Ch. rufifacies* had not been previously recorded was selected. Carcasses were closed off to fly-strike after set periods with early closure predicted to exclude the secondary fly *Ch. rufifacies* from striking if this species was present. Three areas within the participating sheep property each containing three sites were selected from the most homogeneous sheep grazing land available, to maintain uniformity between blocks and treatments. The experiment was conducted during April 2000 and dismantled in December 2000 after over-wintering flies had emerged.

Nine freshly culled possums with mean weights of 3.5 ± 0.1 kg were randomly allocated to one of three areas within the property, and then assigned to one of three independent sites within that area. Possum carcasses were placed into possum boxes inside protective cages, with each carcass within an area having differing time availability for fly oviposition. Carcasses were available for oviposition from the initial placement of the carcass in the field, but oviposition was made unavailable after 2, 5 and 15 days by enclosing the possum cage with an insect emergence net. Thus, each of the three areas had one possum carcass with the following treatment:

- available for oviposition at day 0 and unavailable after day 2,
- available for oviposition at day 0 and unavailable after day 5,
- available for oviposition at day 0 and unavailable after day 15.

External probe temperature data loggers were positioned into possum carcasses from one area to monitor core temperatures. Ambient temperature was recorded at this site. Ambient and possum core temperatures were recorded at 1 hour intervals. Insect emergence nets and fly-trap containers were set as for the previous possum carcass study. Fly-trap containers were emptied regularly.

***Identification of fly-strike species***

All flies trapped from insect emergence nets and fly-traps were deposited in resealable plastic bags and stored at -20°C until identification.

The characteristic metallic green thorax and abdomen separated *L. cuprina, L. sericata* and *Ch. rufifacies* from *C. stygia*. The white coloured anterior thoracic spiracle of *Ch. rufifacies* (I. Dadour, University of Western Australia, pers. comm., 2000) was then used to isolate this species from *L. cuprina* and *L. sericata*. The increased number of hairs of the humeral calli and notopleuron area in *L. sericata,* and the increased sclerotisation of the clypeus and metallic green colouration of the fore femora associated with *L. cuprina* (Waterhouse and Paramonov, 1950) separated the two *Lucilia* species.

The key developed by Malloch (1927) was used for identification of calliphorid species. The differentiation of *C. stygia* from *C. augur* and *C. vicina* was centred on the relatively uni-colorous yellow grey abdomen of *C. stygia*. Differentiation of *C. stygia* from *C. hilli* was based on the presence of three presutural acrostichal bristles on C. stygia in comparison to two on *C. hilli*.

All flies that emerged from possum carcasses were identified. Where emergence of *Ch. rufifacies* exceeded 500 individuals from a sheep carcass, an estimated population was evaluated from their volume as described by Horton *et al* (1999).

## Results

***Sheep carcasses***

*Lucilia cuprina* successfully reproduced from all five carcasses with an average of 127 ± 44 flies per carcass (Table 1). Of the other fly species of importance to fly-strike in Tasmania, *L. sericata, C. stygia,* and *Ch. rufifacies* (Watts *et al.,* 1976; McQuillan *et al.,* 1983), *Ch. rufifacies* emerged from all five carcasses, with *C. stygia* emerging from four and *L. sericata* emerging from none. Analysis of *L. cuprina, C. stygia* and *Ch. rufifacies* emergence showed a significant difference (ANOVA: $F_{2,8}$=9.25, P=0.008) between reproductive success, with *Ch. rufifacies* the most abundant species followed by *L. cuprina* and then *C. stygia*. The number of *L. cuprina* to emerge represented on average 4.0% of the fly-strike populations to successfully reproduce from sheep carcasses.

**Table 1. The mean emergence ± SE and range (in parentheses) of fly-strike species from sheep carcasses at Gladstone (n=5) with fly-strike at the time of death.**

| *L. cuprina* | *L. sericata* | *C. stygia* | *Ch. rufifacies* |
|---|---|---|---|
| 127 ± 44 | 0 | 21 ± 10 | 2948 ± 1579 |
| (52-294) | (0) | (0-34) | (9-8113) |

### *Possum carcasses*

Of the major fly-strike species in Tasmania, *C. stygia* emerged from all nine possum carcasses, with *Ch. rufifacies* emerging from eight and *L. sericata* emerging from seven. *L. cuprina* was the least successful of the four fly-strike species, only being represented in two of the nine carcasses. The emergence of *Ch. rufifacies* from carcasses at Kempton increased the known spatial distribution of this species in Tasmania, as previously *Ch. rufifacies* had only been trapped as far south as Ross (42$^{o}$02'S) (McQuillan *et al*., 1983).

A significant difference (nested ANOVA: $F_{9,24}$=8.81, P=0.0001) occurred between the reproductive success of *L. cuprina, L. sericata, C. stygia* and *Ch. rufifacies,* with *C. stygia* and *Ch. rufifacies* the most abundant species to reproduce from possum carcasses (Table 2). At Gladstone and Kempton, *C. stygia* was the dominant species to emerge, whereas at Campbell Town *Ch. rufifacies* was dominant. A strong negative correlation (Spearman $r^2$=0.83, P<0.05) was observed between the emergence of *C. stygia* and *Ch. rufifacies*. Both *C. stygia* and *Ch. rufifacies* reproduced in significantly greater numbers than *L. sericata*, which averaged a maximum of 39 flies per carcass at Kempton but was frequently in very low numbers. *Lucilia sericata* emerged from possum carcasses in significantly greater numbers than *L. cuprina*, where only seven and four flies emerged from two possum carcasses at Gladstone. The number of *L. cuprina* to emerge accounted for less than 0.4% of the total number of fly-strike flies emerging from the two carcasses.

**Table 2. The mean emergence ± SE and range (in parentheses) of fly-strike species from possum carcasses at Gladstone (n=3), Campbell Town (n=3) and Kempton (n=3).**

| Species | Gladstone | Campbell Town | Kempton |
|---|---|---|---|
| *L. cuprina* | 3.7 ± 2.0 | 0 | 0 |
| | (0-7) | (0) | (0) |
| *L. sericata* | 0.3 ± 0.3 | 8.7 ± 3.3 | 39 ± 22 |
| | (0-1) | (4-15) | (8-82) |
| *C. stygia* | 683 ± 594 | 30 ± 16 | 547 ± 463 |
| | (50-1870) | (11-62) | (37-1472) |
| *Ch. rufifacies* | 315 ± 181 | 813 ± 256 | 203 ± 107 |
| | (11-636) | (423-1294) | (0-363) |

No significant differences were recorded between the number of flies trapped in a wind orientated fly-trap placed adjacent to a fresh possum carcass compared with fly-traps placed at north, south, west and east directions from the carcass. However, there were large discrepancies between the proportions of the different fly species in the carcass fly-trap compared with the number emerging from the carcass. At Gladstone and Kempton, *C. stygia* represented 38% and 18% respectively of the total number of flies attracted to a carcass fly-trap but accounted for 68% and 69% of the total number of flies to emerge (Table 3). Similarly, at Campbell Town, *Ch. rufifacies* represented 96% of the total number of flies to emerge from possum carcasses, but was not recorded in wind orientated fly-traps positioned at the fresh possum carcasses. In contrast, *L. cuprina* accounted for approximately 62% of the flies attracted to the carcass fly-trap at Gladstone, but represented less than 0.4% of the total number of flies to reproduce from the carcass.

**Table 3. The relative proportions of fly-strike species attracted to and emerging from possum carcasses at Gladstone, Campbell Town and Kempton, expressed as percentages.**

| | Gladstone | | Campbell Town | | Kempton | |
|---|---|---|---|---|---|---|
| Species | attraction | emergence | attraction | emergence | attraction | emergence |
| *L. cuprina* | 61.7 | 0.4 | 30.4 | 0 | 14.3 | 0 |
| *L. sericata* | 0 | 0 | 43.0 | 1.0 | 67.8 | 4.9 |
| *C. stygia* | 38.3 | 68.1 | 26.6 | 3.5 | 17.9 | 69.4 |
| *Ch. rufifacies* | 0 | 31.5 | 0 | 95.5 | 0 | 25.7 |

Possum core temperatures from Campbell Town and Kempton showed that temperatures within possum carcasses were elevated above ambient temperature (Figure 1). The maximum temperature attained in the possum carcass at Campbell Town was 45.1$^{o}$C or 9.9$^{o}$C above ambient, whilst at Kempton it was 51.9$^{o}$C or 15.2$^{o}$C above ambient. The possum carcass at Kempton had core temperatures above 45$^{o}$C, 40$^{o}$C and 30$^{o}$C for a total of 11, 22 and 95 hours respectively, whereas the carcass at Campbell Town had core temperatures above these temperatures for a total of 1, 12 and 110 hours respectively. Furthermore, the longest continuous time possum carcasses remained above 45$^{o}$C, 40$^{o}$C and 30$^{o}$C was for 1, 7 and 41 hours at Campbell Town, and 3, 5 and 30 hours at Kempton. The main fly-strike species to emerge from these possum carcasses was *Ch. rufifacies* with 1294 and 245 individuals at Campbell Town and Kempton respectively. These numbers represented 99% and 64% of the fly-strike species to emerge. The next most abundant to emerge at both locations was *C. stygia*, with 34% of the species to emerge from the Kempton carcass. No temperature data was available from Gladstone.

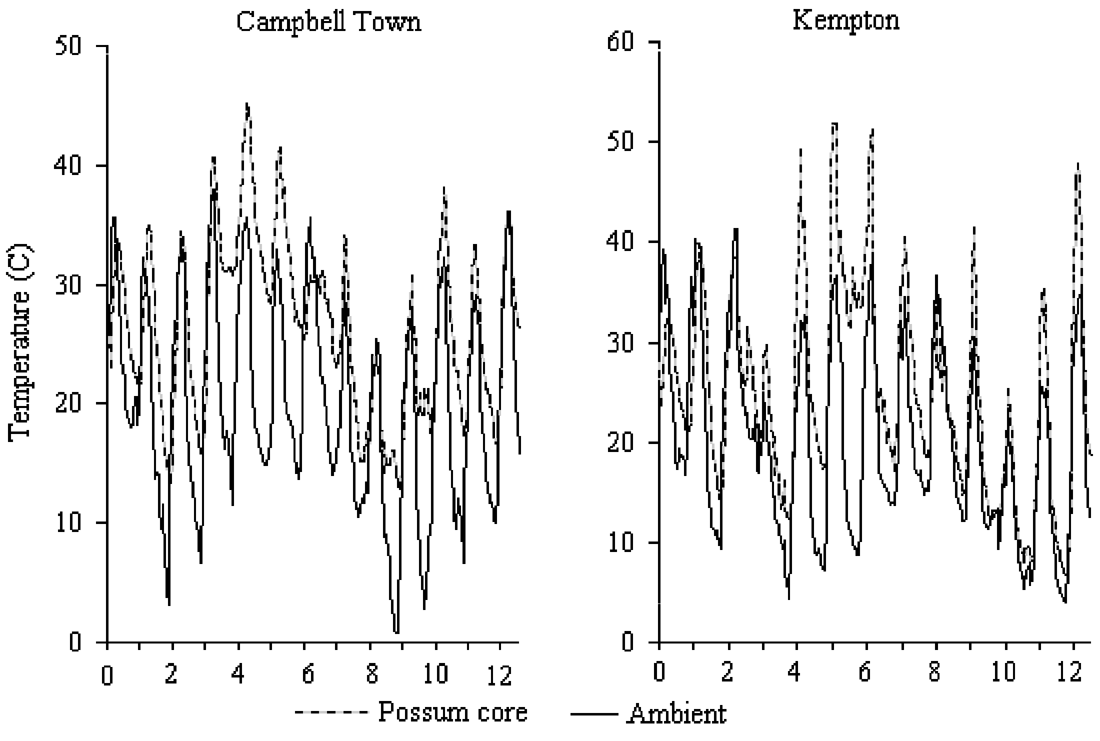


**Figure 1. Possum core and ambient temperature from days 0-12 at Campbell Town and Kempton (Feb. 2000).**

Assessment of larvae sub-samples from carcasses immediately prior to possum carcass enclosure confirmed the presence of *Ch. rufifacies* and *C. stygia* in all three regions. *Lucilia sericata* and *L. cuprina* were obtained from only one location each, *L. sericata* at Campbell Town and *L. cuprina* at Gladstone.

Identification of predatory arthropods sourced from pit-fall traps positioned alongside carcasses, established the presence of the insect orders Dermaptera and Coleoptera (families: Histeridae, Silphidae, Staphylinidae), and the class Arachnida (Order: Aranae). However, there was negligible correlation between emerging fly numbers and the abundance of arthropods that predate on fly larvae, either at an individual family or class level, or as a combined total.

***Possum carcasses: exclusion experiment***

Of the four major fly-strike species in Tasmania, *L. sericata* was the only species to emerge from all nine carcasses, with *C. stygia* the next most successful emerging from eight carcasses. *Lucilia cuprina* emerged from five carcasses, one less than *Ch. rufifacies*. The emergence of *Ch. rufifacies* at Richmond again increased the known distribution of this species in Tasmania.

A significant difference (nested ANOVA: $F_{9,24}$=3.94, P=0.003) was revealed between the reproductive success of *L. cuprina, L. sericata, C. stygia* and *Ch. rufifacies* (Table 4). On average, the most abundant species to emerge from 0-2 day carcasses was *L. sericata*, whereas *Ch. rufifacies* was the most abundant species to emerge from 0-5 and 0-15 day carcasses. *Chrysomya rufifacies* also emerged from the 0-2 day possum carcasses, but represented only 1.2% of the emerging fly population. A significant negative relationship occurred between *L. sericata* and *C. stygia*, with *C. stygia* acting as a covariate on the emergence of *L. sericata* (ANCOVA: Treatment, $F_{2,5}$=0.04, P=0.56; *C. stygia*, $F_{1,5}$=6.92, P=0.046). While *L. cuprina* emerged from five of the nine possum carcasses, it was the least successful of the four fly-strike species. The number of emerging *L. cuprina* ranged from 1 to 6 flies per carcass and represented less than 0.7% of the total number of fly-strike flies emerging from these five carcasses.

**Table 4. The mean emergence ± SE and range (in parentheses) of *L. cuprina, L. sericata, C. stygia* and *Ch. rufifacies* from possum carcasses available for oviposition for 2 days (0-2), 5 days (0-5) and 15 days (0-15) at Richmond.**

| Species | 0-2 | 0-5 | 0-15 |
|---|---|---|---|
| *L. cuprina* | 2.3 ± 1.9 | 0.7 ± 0.7 | 1.3 ± 0.9 |
| | (0-6) | (0-2) | (0-3) |
| *L. sericata* | 188 ± 62 | 143 ± 77 | 256 ± 181 |
| | (74-307) | (22-287) | (44-716) |
| *C. stygia* | 173 ±140 | 83 ± 60 | 88 ± 32 |
| | (19-452) | (0-200) | (27-134) |
| *Ch. rufifacies* | 3.3 ± 3.3 | 2280 ± 2113 | 320 ± 272 |
| | (0-10) | (0-6501) | (61-863) |

In contrast to the previous possum carcass experiment, possum core temperatures were not elevated above 40$^{o}$C. The maximum temperature attained within a possum carcass was 38.0$^{o}$C when the core temperature remained above 30$^{o}$C for 24 hours. All other possum core temperatures were below 28.3$^{o}$C.

## Discussion

Of the fly-strike species in Tasmania, *Ch. rufifacies* was the most successful species to emerge from sheep carcasses, and in association with *C. stygia* and *L. sericata*, the most abundant species to emerge from possum carcasses. In contrast, *L. cuprina* was present in only seven from a possible eighteen possum carcass and was the least successful fly-strike species to emerge from these carcasses. The abundance of *Ch. rufifacies* supports previous studies in mainland Australia where this species was dominant in sheep carrion during summer and early autumn (Waterhouse, 1947; Barton, 1982; Anderson *et al*., 1988), and on Flinders Island between Tasmania and mainland Australia in sheep, wallaby and wombat carrion (McQuillan *et al*., 1983). Furthermore, the dominance of *C. stygia, L. sericata* and *Ch. rufifacies* from possum carcasses supports studies in the North Island of New Zealand, where these species were the most successful to emerge from possum carcasses that were available for oviposition in late summer and early autumn (Dymock and Forgie, 1993; Heath and Appleton, 2000).

In this experiment *L. cuprina* emerged from every sheep carcass with an average of 129 flies and range of 52 to 294 flies per carcass. This is in contrast to other studies in temperate Australia with sheep carcasses that had not suffered fly-strike prior to death. For example, emergence of *L. cuprina* averaged 1.3 flies per carcass with a range of 0 to 4 flies from six sheep carcasses exposed to oviposition during the summer months at Canberra, A.C.T. (Waterhouse, 1947), and an average of 2, 16 and 85 flies emerged during December, January and February respectively from sheep carcasses at Hamilton, Victoria (Barton, 1982). Thus, numbers of *L. cuprina* to successfully reproduce from fly-strike carcasses appear to be higher than non fly-strike carcasses. However, carcasses not suffering fly-strike prior to death were not evaluated in this experiment, therefore this finding should be treated with caution. In either case, the number of *L.*

*cuprina* to emerge from fly-strike and non fly-strike carcasses prior to death appear to be much lower than overt strikes of sheep where it is not uncommon for 3000-9000 adult *L. cuprina* to be produced (Anderson and Simpson, 1991).

Temperatures up to 15.2$^{o}$C above ambient and up to 6.9$^{o}$C above the 40-45$^{o}$C thermal tolerance of *L. cuprina* (Williams and Richardson, 1984) were generated in possum core carcasses at Kempton. Similarly, temperatures were also elevated in the possum carcass at Campbell Town. The elevation of temperatures concur with studies of possum carcasses in the North Island of New Zealand where temperatures up to 18.5$^{o}$C above ambient for discrete periods over 13.5 days were recorded (Appleton, 1993). Similarly, Turner and Howard (1992) recorded elevated temperatures in rabbit carcasses up to 27$^{o}$C above ambient. Williams (1987) also recorded the core temperature of sheep carcasses in excess of 40$^{o}$C for intermittent periods over 60 hours. While core temperatures were not available from carcasses at Gladstone it would appear likely that temperatures of similar magnitude to the carcasses at Campbell Town and Kempton would have been attained at Gladstone.

A factor suggested for limiting *L. cuprina* emergence from carcasses is the presence of predatory *Ch. rufifacies* larvae and the ability of this species to generate temperatures above the thermal tolerance of *L. cuprina* (Waterhouse, 1947). Unfortunately, the reproductive success of *L. cuprina* could not be assessed in possum carcasses at Gladstone, Campbell Town and Kempton without the presence of *Ch. rufifacies*. However, in the one carcass where *Ch. rufifacies* was absent, the most abundant fly-strike species to emerge from possum carcasses was *C. stygia*. This result concurs with Norris (1959), where *L. cuprina* was eliminated at a lower intensity of competition and predation than was *C. stygia* with the introduction of *Ch. rufifacies* into experimental carcasses. The emergence of *C. stygia* in this experiment was despite possum core temperatures being elevated above its calculated lethal threshold of 35-40$^{o}$C (Williams and Richardson, 1984) for extended periods at both Kempton and Campbell Town. Similarly, small numbers of *L. cuprina* emerged from carcasses at Gladstone where the thermal tolerance of this species may have been exceeded. The successful emergence of these species from carcasses suggests that strategies are employed by fly-strike larvae to cope with adverse conditions within the carcass. Those that did emerge may have been from larvae residing on the periphery of the possum carcass, thereby escaping predation and avoiding temperatures above their thermal tolerance. Similarly, by nearing completion of larval development on sheep hosts prior to death, *L. cuprina* larvae may also escape predation and avoid temperatures above lethal temperatures.

In contrast to measurements at Campbell Town and Kempton, possum core temperatures at Richmond did not reach the thermal tolerance of *L. cuprina* larvae. However, *L. cuprina* was again the least successful of the four fly-strike species to emerge with a maximum of 6 specimens from one carcass. *Lucilia sericata* and *C. stygia* emerged in much higher numbers than *L. cuprina* and dominated carcasses until the appearance of the secondary *Ch. rufifacies*. The lack of success by *L. cuprina* was inclusive of the single carcass with elevated core temperature above 30$^{o}$C, and from the three carcasses in which *Ch. rufifacies* emergence did not occur. However, these findings may alter if carcass' core temperatures are elevated above 30$^{o}$C without the presence of *Ch. rufifacies*, a situation that did not occur in this experiment.

In comparison with the number of *L. cuprina* that can be produced from overt strike of sheep, the small number to emerge from possum and sheep carcasses appear to be of less importance for the population size of this species during the late summer and autumn period. However, in the absence of strike on live sheep, carcasses may provide a sufficient resource for sustaining small local populations of *L. cuprina* and therefore enable this species to persist and exploit sheep if and when there is a lapse in flock management. Furthermore, in western Victoria, Barton (1982) observed an increase in *L. cuprina* emergence from sheep carcasses exposed to oviposition during April in comparison with those carcasses exposed during the summer months. In his study, Barton also noted that carcasses exposed in autumn contributed to the initial adult population of *L. cuprina* in the following spring. Therefore, sheep carcasses that have suffered fly-strike prior to death in autumn may be a significant resource for the initial population of *L. cuprina* in the field, a situation that may be assisted in Tasmania by the unpredictable temporal and spatial distribution of *Ch. rufifacies*.

Finally, while McQuillan *et al* (1983) confirmed *L. cuprina* as the leading primary fly-strike species in Tasmania, *C. stygia* accounted for 14% of all single species attacks. Furthermore, *L. sericata* and *Ch.*

*rufifacies* were involved in 32% and 5% of mixed species strikes respectively (Watts *et al*., 1976; McQuillan *et al.*, 1983). In this study possum carcasses offered a significant breeding resource for *L. sericata*, *C. stygia* and *Ch. rufifacies*. Therefore, when considering fly-strike management the disposal of possum carcasses may need to be treated in such a way as to remove this resource from potential fly breeding.

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