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The Effect of Time After Body Discovery on the Accuracy of Retrospective Weather Station Ambient Temperature Corrections in Forensic Entomology

ABSTRACT: Weather station data are used by forensic entomologists to estimate ambient temperatures at body discovery sites. Correlation data from sites may also be collected to correct for site and station differences. This experiment tested the accuracy over time of retrospective weather data correction using linear regression between stations and sites. Temperatures were logged at six hypothetical body discovery sites during a seven-day period for which a hypothetical body lay in situ, and a further four correlation periods. The accuracy of weather data for hypothetical body in situ periods improved after correction in 22 of 24 correlations; however, mean predicted body in situ temperatures for sites differed significantly between correlation periods. Predicted temperatures generally rose with time after body removal, which correlated with rising site temperatures accompanying seasonal change. Therefore, practitioners should be cautious in making correlations if weather patterns during correlation differ greatly from those while the body was in situ.

KEYWORDS: forensic science, forensic entomology, ambient temperature, validation, weather, correlation, Australia, Victoria, decomposition

The progression of decomposition changes to a body, along with the growth and succession rates of infesting insects, is thermally driven (1,2). Because the rates of these processes are temperature dependent, they are useful in estimating the postmortem interval (PMI), and forensic entomologists use insect lifecycle biometry and insect succession rate data to estimate the minimum PMI (3,4).

The study of entomology is centuries old, but the discipline of forensic entomology is relatively young (3,4). It is currently in the midst of rapid development both in techniques (5,6) and in the collection of basic biological data (7,8). Surprisingly, however, there has been little attempt to validate the techniques most commonly used to provide minimum PMI estimates. Exceptions are studies examining molecular and morphological larval identification methods (9), the effects of killing and preservative solutions on maggot age estimates (10), and the validity of using laboratory development data for *Lucilia sericata* Meigen larvae to model field growth rates (11). Experimental validation of PMI estimates may also sometimes be used by practitioners for individual cases (12).

The need to validate forensic entomology techniques is particularly pressing because of recent developments in judicial requirements of expert evidence (13,14). Increasingly, courts in some jurisdictions are demanding that claims made by forensic experts, when derived from the application of tests or techniques, are accompanied by data describing the effectiveness of methods used (14). These demands are being met with recent calls within forensic entomology for validation of techniques (15). The validation process not only would aid the science in gaining judicial acceptance, but would also allow implementation of quality control for practitioner opinions (15).

Obtaining representative temperature data from the body discovery site is essential for forensic entomology cases where minimum PMI estimates are made (16,17). Temperature determines larval growth and insects succession rates (2,7,18); therefore, a record of ambient temperatures is routinely obtained from the weather station nearest to the body discovery site (3,16). However, there may be significant differences between the temperatures experienced at the site and station (16), especially since the body discovery site may be exposed, at a different altitude to the weather station, located in a dwelling (19), or cave (20). Therefore, many practitioners measure discovery site temperatures for a period, which varies between workers (20,21). Generally, a remote temperature logging device is placed in the position the body lay for the correlation period. A regression relationship may then be derived between ambient temperatures simultaneously measured at the site and weather station (22). The derived equation that describes the relationship may then be used to "correct" the weather station temperatures recorded during the time the body is thought to have been in situ by converting them to site temperatures (23). Other workers may simply make note of differences between the two sites and take account of them when performing a minimum PMI analysis (21,22); however, the details of exactly how this is done are unclear.

Anderson (17) cites a case for which separate correlations were performed between body discovery site temperatures and four weather stations close to the body discovery site. Each linear regression performed yielded a high R^2 value (0.82–0.91), the highest being for the weather station closest to the site. Encouragingly, this implies that for the case in question, a large amount of temperature variation between the sites is explained by the linear model. Unfortunately, however, there are no data available on whether regression relationships between body discovery sites and weather stations are likely to vary over time. There are also no data examining the

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accuracy of correlation relationships between body discovery sites and weather stations in retrospective estimation of temperatures when the body lay in situ. Therefore, the degree to which weather data accuracy is improved by correlating body discovery site and weather station data must be measured, and factors likely to produce variation in the success of the technique should be identified.

Correlation data linking the body discovery site and the weather station are ideally collected immediately following body removal, and it has been additionally been recommended that weather data used for correlation are collected when macro weather patterns and ambient temperatures are similar to the period the body is thought to have been in situ (22). However, this may not always be possible as the involvement of the entomologist can be delayed if law enforcement personnel do not immediately recognize the need to consult them on a case. Differences in ambient temperatures prevalent during the body in situ time and the correlation period could modify the thermal relationship between site and weather station, and thus alter the regression relationship. Presumably, progressive seasonal weather change will increase the mean differences between body in situ and correlation ambient temperatures.

An experimental field study was performed in the city of Melbourne (Victoria, Australia) to measure the accuracy of retrospective correlation for a series of hypothetical cases. The effect of differences between body discovery site and length of time after body removal on the correlation technique was assessed.

Methods

Collection of Ambient Temperature Data

Ambient temperature data from hypothetical body discovery sites (see below) were collected with Thermotag™ temperature loggers (Thermodata, South Yarra, Australia), which are used in Victorian forensic entomology casework. These loggers consist of a Thermochron *i*Button™ temperature recorder (Dallas Semiconductor, Dallas, TX) mounted on a plastic oval measuring 8.5 × 5 cm. The Thermotags™ used here measure temperatures between −10°C to +85°C. The weather station ambient temperatures used in correlations were obtained from the Bureau of Meteorology's Melbourne Regional Office (MRO) station (Lonsdale St, central Melbourne).

There are differences in the temperature measurement accuracy, resolution and logging interval between Thermotags™ and the MRO weather station. Thermotags™ have a temperature resolution of 0.5°C, an accuracy of ±1°C. The logging interval was 30 min. Whereas, the MRO weather station logs temperature every 3 h, has an accuracy of ±0.2°C, and a resolution of 0.1°C. Therefore, MRO station temperatures were rounded to the nearest 0.5°C, and the accuracy here is considered to be ±1°C. The temperature interval is set at every 3 h, and Thermotag™ observation taken closest to the three hourly MRO observations was used as comparison measurements from the hypothetical site. The greatest time difference between the site and station measurement time was 12 min. Considering the degree of rounding employed, this timing difference is considered to be of negligible importance.

TABLE 1—*Location details for the six hypothetical body discovery sites used, and position in relation to the Melbourne Regional Office (MRO) weather station.*

Logger Number	Site	Suburb	Direction from MRO Station	Distance from MRO Station, km
1	Back yard	Carlton	N	2.3
2	Back yard	South Yarra	SE	3.5
3	Roof of three-story building	Parkville	NW	1.6
4	Back yard	Fitzroy	E	1
5	Back yard	Northcote	NE	4.5
6	Roof of two-story building	Southbank	SW	1.6

Hypothetical Body Discovery Sites and Logging Periods

This experiment tested whether the timing of the correlation period after body removal affects the accuracy of retrospective weather data correction. Six hypothetical body discovery sites were chosen within a five-kilometer radius of the MRO weather station. These sites were secure (loggers could not be moved), and were at several heights above the ground, in different directions from the MRO station, and at varying distances from the station (Table 1). One Thermotag™ temperature logger was placed at each hypothetical body discovery site, and left undisturbed for a series of logging periods (Table 2). Loggers were shaded, and were located away from the walls of heated buildings, and away from heat-producing equipment to allow a wider range of temperature variation.

The first logging period was seven consecutive days that the hypothetical body lay in situ. This interval, called the "body in situ" period, represented the time between the day of death and body discovery in each hypothetical case. Loggers began recording for the "body in situ" period between Sept. 13 and Sept. 23, 2002. The next logging period, called correlation one (abbreviated to C1), was ten consecutive days. This represented the placement of the logger at the hypothetical body discovery site the day after body removal (Table 2). Temperatures were then logged for a further three correlation periods, also of ten days each (C2, C3, C4; Table 2). These periods occurred at increasing intervals after the "body in situ" period.

Correlation period temperatures and MRO weather station temperatures were used to produce linear regression equations for each of C1–4 at the six sites (24 equations). "Body in situ" period temperatures for each site were then retrospectively predicted by correcting MRO weather data recorded during the "body in situ" period. The accuracy of these estimates was assessed by comparing estimated temperatures with actual temperatures collected during the "body in situ" period. Two hypothetical case studies were also constructed to investigate the potential errors in estimating PMI that may occur using weather data from each of the correlations.

TABLE 2—*Periods (days) for which temperatures were logged at each of the hypothetical body discovery sites.*

Logger Locations	Logging Periods at Each Location (Days)				
	Hypothetical Body in situ	Correlation 1	Correlation 2	Correlation 3	Correlation 4
Sites 1–6	1–7	8–17	18–27	36–45	85–94

Data Analysis

Data were analyzed using Systat 9. Data subjected to linear regression were first inspected for linearity. Data subjected to ANOVA were first inspected for normality.

Results

The R^2 values ranged between 0.7 and 0.9 for correlations between sites and weather stations during C1–4 (Table 3), and thus a large amount of the temperature variation between the sites and weather stations was explained for each correlation. A repeated measures ANOVA was performed to examine potential variation in the R^2 values between sites over C1–4. No significant difference in the R^2 value was found either between correlation periods within sites ($F_{3,15} = 0.6$, $p > 0.5$) or between sites ($F_{3,3} = 1.5$, $p > 0.3$).

Multiple Pearson correlations, using a Bonferroni correction, were performed between the mean site temperatures ("body in situ" period), mean MRO weather station temperatures ("body in situ" period), and the mean estimated temperatures ("body in situ" period) using C1–4 equations. The Bonferroni correction reduces the chance of detecting a false significant correlation simply because a large number of comparisons are being made. There was a significant correlation between the mean site temperatures ("body in situ" period) and the mean C1 estimated site temperatures ("body in situ" period; Table 4). However, there were no significant correlations between the mean site temperatures ("body in situ" period), mean MRO station temperatures ("body in situ" period), or mean site temperatures ("body in situ" period) and temperatures estimated for the "body in situ" period using C1–4 (Table 4).

Repeated measures ANOVA revealed a significant difference between the mean temperatures predicted during the "body in situ" period for correlations one to four ($F_{3,15} = 6.5$, $p < 0.05$). The mean predicted temperature was highest during period four, followed by three, one and two (Fig. 1). Further, there was a significant positive linear relationship between the mean temperatures estimated for the "body in situ" period using C1–4 equations, and the mean temperature measured at the six sites during C1–4 ($R = 0.6$, $F_{1,22} = 13.5$, $p < 0.01$). The mean estimated "body in situ" period temperature (°C) = 8.2 + 0.4* mean site temperature (°C) during correlation. Therefore, the estimated mean "body in situ" period temperature was generally higher when the site temperature was higher during the correlation period (Fig. 2).

TABLE 3—*R^2 values for each of the correlations made between logger and weather station ambient temperatures measured during correlation periods.*

Logger Number	Correlation 1	Correlation 2	Correlation 3	Correlation 4
1	0.8	0.8	0.7	0.8
2	0.8	0.8	0.8	0.9
3	0.7	0.9	0.6	0.7
4	0.9	0.9	0.9	0.8
5	0.9	0.9	0.8	0.9
6	0.9	0.7	0.9	0.9

TABLE 4—*R-values from multiple correlations with Bonferroni correction performed between mean temperatures at hypothetical body discovery sites ("body in situ" period), mean weather station temperatures ("body in situ" period), and mean "body in situ" period temperatures estimated from the four correlation periods (correlation 1–4).*

Correlation	R-Value
Site vs. station	0.23
Site vs. correlation 1	0.97*
Site vs. correlation 2	0.81
Site vs. correlation 3	0.69
Site vs. correlation 4	0.55

* $p < 0.05$.

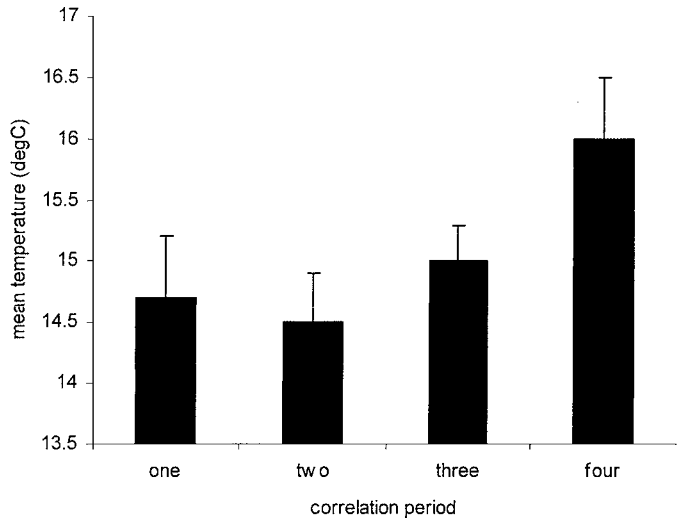

FIG. 1—*Mean estimated temperatures for the "body in situ" period (+SE) predicted by the equations produced during each of the four correlation periods.*

Absolute temperature differences were calculated between the site ("body in situ" period) and MRO weather station temperatures ("body in situ" period), and also between site ("body in situ" period) and estimated "body in situ" period temperatures for each correlation equation. Comparison between these two sets of absolute differences reveals that corrected weather data were more representative of actual site temperatures during the "body in situ" period in 22 out of 24 correlations made (Table 5). This was both in terms of reduced mean absolute temperature differences, and also reduced sum of the absolute temperature differences (Table 5). Therefore, the accuracy of temperature data for the "body in situ" period was usually improved by the correlation method.

Repeated measures ANOVA demonstrated significant variation between the mean absolute differences calculated for correlation period ($F_{4,20} = 3.8$, $p < 0.02$; Table 5). The mean absolute difference was highest between the site ("body in situ" period) and MRO weather station ("body in situ" period) temperatures (mean = 1.9 ± 0.3), followed by the mean absolute difference between the sites ("body in situ" period) and the estimated site (C4) temperatures (mean = 1.7 ± 0.3), sites ("body in situ" period) and estimated site (C3) temperatures (mean = 1.2 ± 0.3), sites ("body in situ" period) and estimated site (C2) temperatures (mean = 1.1 ± 0.1), and finally, between sites ("body in situ" period) and estimated site (C1) temperatures (mean = 0.9 ± 0.1).

Similarly, repeated measures ANOVA revealed significant variation between the sums of differences for the two absolute difference datasets ($F_{4,20} = 3.8$, $p < 0.03$). The mean sum of absolute differences was greatest between the site ("body in situ" period) and the MRO station ("body in situ" period) temperatures (mean = 108.7 ± 16.9), followed by the mean sum of differences between site and estimated site (C4) temperatures (93.5 ± 14.7), sum of differences between site and estimated site (C3) temperatures (mean = 67.3 ± 15.5), sum of differences between site and estimated site (C2) temperatures (mean = 59 ± 4.2), and finally, sum

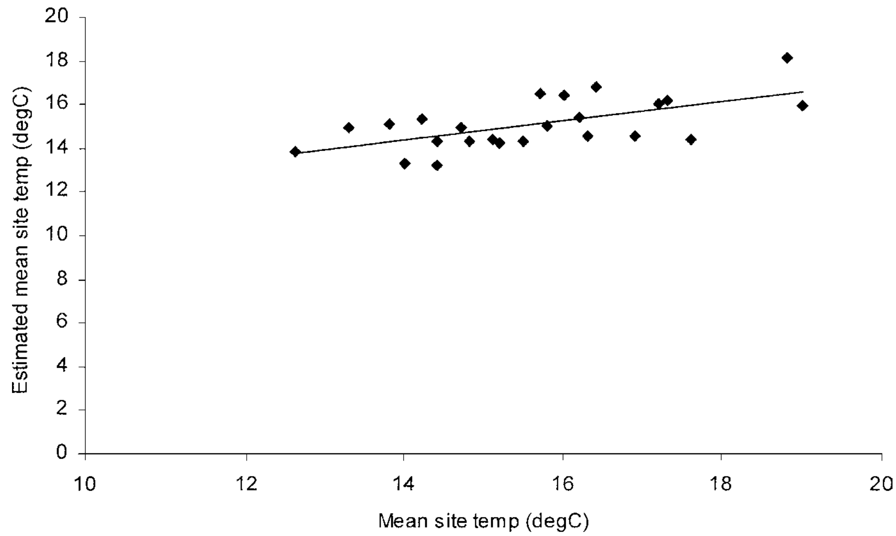

FIG. 2—*Scatter plot and line of best fit for regression: estimated mean site temperature (°C) versus mean site temperature during each correlation period (°C).*

TABLE 5—*Absolute differences between hypothetical body discovery site temperatures (°C; "body in situ" period) and city weather station temperatures (°C, "body in situ" period), as well as absolute differences between hypothetical body discovery site temperatures (°C) and estimated body discovery site temperatures (°C) from correlation periods one to four. Data are means ±SE, and sums. Site = hypothetical body discovery site ("body in situ" period), station = MRO weather station ("body in situ" period), correlation one to four = estimated temperatures during the "body in situ" period for each of the four correlations.*

Logger	Temperature Differences	Mean Absolute Difference (±SE)	Σ of Absolulte Differences
1	Site–Station	3 (±1.3)	169
1	Site–Correlation 1	1.3 (±0.1)	70.5
1	Site–Correlation 2	1.1 (±0.1)	63
1	Site–Correlation 3	2.5 (±0.2)	141.5
1	Site–Correlation 4	2.3 (±0.2)	126.5
2	Site–Station	1.8 (±0.2)	102
2	Site–Correlation 1	0.8 (±0.1)	44
2	Site–Correlation 2	1.2 (±0.1)	68
2	Site–Correlation 3	1.1 (±0.1)	64
2	Site–Correlation 4	2.6 (±0.2)	146
3	Site–Station	2.2 (±0.2)	124
3	Site–Correlation 1	0.8 (±0.1)	42
3	Site–Correlation 2	1 (±0.1)	56.5
3	Site–Correlation 3	0.9 (±0.1)	50
3	Site–Correlation 4	1.6 (±0.1)	87.5
4	Site–Station	1.4 (±0.2)	76
4	Site–Correlation 1	0.7 (±0.1)	36.5
4	Site–Correlation 2	0.8 (±0.1)	44.5
4	Site–Correlation 3	0.8 (±0.1)	44.5
4	Site–Correlation 4	1 (±0.1)	54
5	Site–Station	0.9 (±0.1)	52.5
5	Site–Correlation 1	0.7 (±0.1)	39
5	Site–Correlation 2	0.9 (±0.1)	51
5	Site–Correlation 3	0.7 (±0.1)	38
5	Site–Correlation 4	1.5 (±0.1)	84
6	Site–Station	2.3 (±0.2)	128.5
6	Site–Correlation 1	1.1 (±0.1)	63
6	Site–Correlation 2	1.3 (±0.1)	71.5
6	Site–Correlation 3	1.2 (±0.1)	65.5
6	Site–Correlation 4	1.1 (±0.1)	63

of differences between site and estimated site (C1) temperatures (mean = 49.2 ± 5.7).

Practitioners have available station data only for the time the body was in situ when they are making a correlation for a case, and may benefit from inspecting differences between body in situ and correlation weather data. Therefore, the relationship between weather station temperatures and data correction accuracy was investigated. The mean absolute temperature differences between the MRO station ("body in situ" period) and the MRO station (C1–4) was calculated for the six sites. These values were then regressed against the mean absolute differences between site temperatures ("body in situ" period) and estimated site temperatures (C1–4). There was a significant positive relationship between these two variables ($R = 0.6$, $F_{1,22} = 10.1$, $p < 0.005$; Fig. 3). The mean absolute difference between the site (body in situ) and estimated site (C1–4) temperatures (°C) = −0.5 + 0.4* mean absolute difference between the MRO weather station ("body in situ" period) temperatures and the MRO station (C1–4) temperatures (°C). Therefore, the accuracy of retrospective correction generally reduced as differences between weather station data collected during the "body in situ" period and correlation period increased.

Effects of Temperature Estimation Errors on PMI Estimates

Hypothetical Scenario A—Larvae of *Calliphora vicina* Robineau-Desvoidy (Diptera: Calliphoridae) were collected from a body discovered at Site 1. The larvae were collected and fixed while the body was in situ at 21:00 h on Sept. 19, 2002. They were newly moulted into the third larval instar, and the rigorous and widely available growth rate data of Anderson (7) are used here to age them. To avoid complication, no attempt is made to factor in the effects of mass heating. Larval development corresponds with a mean of 2022–2306 ADH at 15.8°C (7), and the actual larval age range was calculated using Site 1 temperatures during the "body in situ" period (Table 6). If uncorrected weather data were used to age the larvae, an underestimate of up to 36 h could be made (Table 6). The estimate using correlation 1 data corresponds closely with the actual larval age range, while the correlation 2 estimate corresponds exactly (Table 6). Correlation 3 data give an underestimate up to 36 h, and correlation 4 data give an underestimate of up to 45 h (Table 6).

Hypothetical Scenario B—Larvae of *C. vicina* were collected from a body discovered at Site 3. The larvae were collected and fixed while the body was still in situ at 21:00 h on the 20 Sept. 2002. The

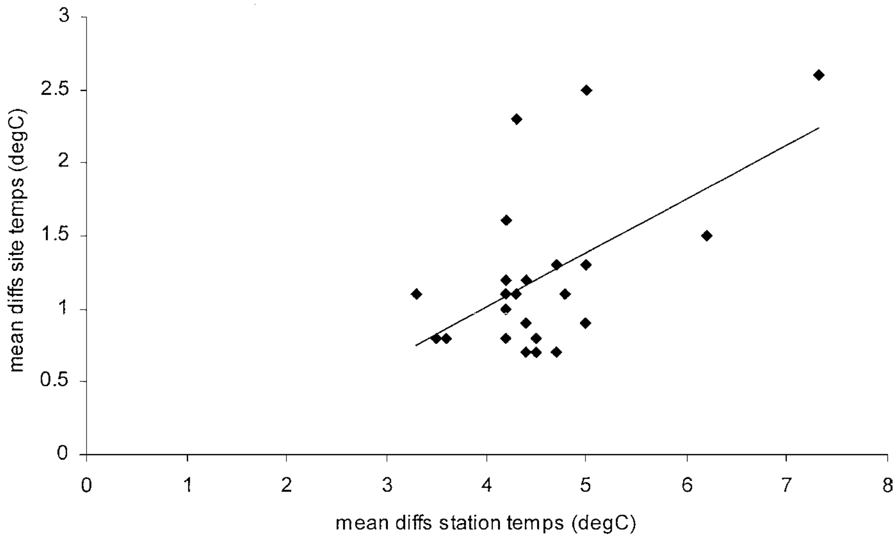

FIG. 3—*Scatter plot and line of best fit for regression: mean absolute difference between the site ("body in situ") and estimated site (C1–4) temperatures (°C) versus mean absolute difference between the MRO weather station ("body in situ" period) temperatures and the MRO station (C1–4) temperatures (°C).*

TABLE 6—*Minimum PMI estimates for hypothetical case studies A and B. Upper and lower limits are given for each estimate. MRO station = Melbourne Regional Office weather station.*

Weather Data Set	Estimated Upper Limit	Estimated Lower Limit
	HYPOTHETICAL CASE A	
Site 1 (body in situ)	0:00 h, 13 sept.	18:00 h, 13 Sept.
MRO station (body in situ)	18:00 h, 13 Sept.	12:00 h, 14 Sept.
Correlation 1	3:00 h, 13 Sept.	21:00 h, 13 Sept.
Correlation 2	0:00 h, 13 Sept.	18:00 h, 13 Sept.
Correlation 3	18:00 h, 13 Sept.	12:00 h, 14 Sept.
Correlation 4	6:00 h, 14 Sept.	21:00 h, 14 Sept.
	HYPOTHETICAL CASE B	
Site 3 (body in situ)	0:00 h, 17 Sept.	6:00 h, 17 Sept.
MRO station (body in situ)	6:00 h, 16 Sept.	9:00 h, 16 Sept.
Correlation 1	0:00 h, 17 Sept.	6:00 h, 17 Sept.
Correlation 2	0.00 h, 17 Sept.	6:00 h, 17 Sept.
Correlation 3	21:00 h, 16 Sept.	0:00 h, 17 Sept.
Correlation 4	12:00 h, 17 Sept.	15:00 h, 17 Sept.

larvae were newly moulted into the second larval instar. The data of Anderson (7) were again used to age them, and no attempt was made to factor in the effects of mass heating. Larval development corresponds with a mean of 1311–1390 ADH at 15.8°C (7), and the actual larval age range was calculated using Site 3 temperatures during the "body in situ" period (Table 6). If uncorrected weather data were used to age the larvae, an overestimate of up to 33 h could be made (Table 6). The estimates using correlation 1 and 2 data correspond with the actual larval age range (Table 6). Correlation 3 data provides a slight underestimate, and correlation 4 data give an underestimate of up to 15 h (Table 6).

Discussion

This experiment represents one of the first attempts to validate and test the accuracy of a forensic entomology technique. Weather data that were retrospectively corrected using the correlation method usually provided a more accurate representation of site temperatures during the "body in situ" period than uncorrected data, regardless of time after body removal. This finding therefore provides increased rationale for performing retrospective correction of weather data in casework.

Mean absolute differences between the site data during the "body in situ" period and the corresponding weather data were usually reduced significantly when weather data were corrected. Many of the improvements measured would be large enough to impact greatly on minimum PMI estimates; however, when the data were used to age fly larvae in hypothetical case scenarios it could be seen that some improvements were too small to impact on the PMI estimate. If constant temperature growth rate data were used, a more representative mean temperature should usually be derived from corrected data. Alternatively, if Accumulated Degree techniques were used, a more accurate calculation of thermal units should usually result from correcting weather data. This may be especially true if weather station data are fluctuating around developmental thresholds at which larval growth is presumed suspended. If temperatures at site of body discovery regularly cross these thresholds at different times to the weather station, a misleading Accumulated Degree calculation may result from using uncorrected weather data.

It should be noted that while the accuracy of data at particular sites was usually improved by correction, the degree of improvement was highly variable between correlation periods. Also, and most importantly, retrospective correction did not always improve the accuracy of weather data; in two out of 24 trials, the technique actually decreased the accuracy of the weather data. Both of these replicates were within the correlation four treatment, and represented the furthest correlation time from the "body in situ" period. It is also worth noting that the R^2 values for these correlations were high, and provided no indication that the correction method would fail. This underlines the critical importance for forensic entomologists to add generous error margins to their minimum PMI estimates, especially while there are currently so many gaps in our knowledge. The hypothetical scenarios presented here were calculated with greater precision than the author would normally employ in casework. It is a personal practice in most cases to give minimum PMI estimates with an error margin of *at least* ± 12 h, and error margins of days, weeks, or even months are commonly given.

Weather conditions during the correlation and "body in situ" periods appeared to affect the outcome of retrospective correction. The mean estimated site temperatures for the "body in situ" period rose significantly with time after the event, and there was evidence that this was influenced by average temperatures rising throughout the experiment as spring progressed into summer. Increases in mean site temperatures during each correlation period were linearly related to increases in mean predicted temperatures during the "body in situ" period. It is quite possible that the opposite effect is produced during progression from the warmer to the cooler months of the year.

The nature of thermal relationships between sites of body discovery and local weather stations is likely to be highly variable, not just between sites, but also within sites in different seasons. Therefore, the results of this experiment should not be generalized. However, the relationship between the "body in situ" period weather station data and the correlation period weather station data provided an indication of the level of improvement gained by correcting the body in situ period weather data. It is generally true that greater mean absolute differences between weather station temperatures during the body in situ and correlation periods resulted in greater absolute differences between mean actual and estimated temperatures at sites. Caseworkers must obtain weather station data during the body in situ and correlation periods in order to make a retrospective correction; thus it may be advantageous to inspect the absolute differences between the two data sets. It is impossible at this early stage to provide guidelines on what level of difference between the two data sets will provide an inaccurate correction. However, during this experiment, a mean absolute difference between body in situ and correlation weather station data of approximately 6°C–7°C yielded corrected weather data that were less representative of site (body in situ) data than uncorrected weather data.

The data collected during this experiment were relatively consistent compared with the amount of variation that may potentially have occurred over three months: the state of Victoria has an anecdotal reputation for meteorological variation, even within each day. The low level of weather variation may also have been complimented in part by the relative stability of temperatures at the experimental sites. It was decided that this initial study should not be complicated by the introduction of great differences between sites and weather stations, and that more dramatic site and station differences should form the subject of a separate experiment. Hence, loggers were kept shaded. Dramatic fluctuation may complicate the thermal relationship between sites and stations since more variation must be explained by a regression model. Variation of this nature could be additive or interactive; for example, great temperature fluctuation through periodic sun exposure will not only intermittently increase air temperatures around a logger, but will also heat objects in proximity, as well as dry out wet soil or clothing. This may in turn produce additional variation in ambient temperatures that cannot be explained by simple correlation between site and station.

Conversely, there is evidence that maggots may partially regulate their own temperature during development by massing to increase temperature, and by moving out of masses to reduce temperature (24). This may increase the uniformity of the temperatures experienced by maggots, and may therefore smooth some of the variation in temperatures external to the body. More information describing the link between ambient site temperatures and the temperatures experienced by maggots is therefore needed to complement data describing the link between site and weather station temperatures.

Changes can occur in the body discovery site itself, which may impact on the accuracy of correlations performed at extended times after body removal. Trees can be cut down, and buildings constructed; even the growing or cutting of grass may modify the thermal relationship between the site and weather station. It is therefore beneficial to examine before and after photographs of the site in question before a correlation is performed if it cannot be done immediately after body removal.

Further work of this nature would help to elucidate the strengths and weaknesses of retrospective weather data correction. The effect of season, distance from the weather station, sun and shade, and indoor and outdoor settings may all impact on the accuracy of this technique. These results indicate that time after body removal can decrease the benefit gained by retrospective correction, and this decrease appears to be largely due to differences between weather conditions during the correlation and "body in situ" periods. Differences can occur between body in situ and correlation period temperatures even if correlation data are collected immediately following body removal. Therefore, a long logging period of at least ten days with a remote logging device is recommended because a large correlative data set allows the practitioner to select and discard temperature data based on their similarity to temperatures experienced during the "body in situ" period.

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