Estimating PMI using blow flies
- determine decay stage
- collect and identify insects
- collect climate data
- site of infestations on body
- developmental stage of blow flies
- use largest (longest time there)
- other insect evidence might corroborate or contradict pmi estimate.

Use of degree days to estimate PMI
- Accumulated Degree-Hours (ADH)
- time x temperature = growth/stage of insects
- know temperature and growth/stage of insects, easy to find time
- maggot-generated heat problems
  - rate of development

Development time dependent on temperature – ADH is constant

Box 6.2
development of each stage is dependent on temperature

Degree-day process: estimate area under a daily temperature curve that is above the minimum development threshold (~ 6° - 10°C)

Temperature-dependent fly development

Figure 9.2. Degree-days, a measure of physiological time, indicated as the area under a daily temperature curve and above a minimum developmental temperature for a species.
Rates of development vary among species. Knowledge of species ID is critical for predicting PMI.

### Development times of particular fly species - in hours

<table>
<thead>
<tr>
<th>Species</th>
<th>Lower Threshold (°C)</th>
<th>ADH</th>
<th>ADD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calliphora vomitoria</td>
<td>6</td>
<td>17678</td>
<td>737</td>
</tr>
<tr>
<td>Cynomyopsis cadaverina</td>
<td>6</td>
<td>5511</td>
<td>229</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Lower Threshold (°C)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Calliphora stygia</td>
<td>6</td>
<td>17678</td>
<td>737</td>
</tr>
<tr>
<td>Calliphora augur</td>
<td>6</td>
<td>5511</td>
<td>229</td>
</tr>
<tr>
<td>Chrysomyia rufifacies</td>
<td>6</td>
<td>17678</td>
<td>737</td>
</tr>
<tr>
<td>Hydrotaea rostrata</td>
<td>6</td>
<td>17678</td>
<td>737</td>
</tr>
</tbody>
</table>

Complete lifecycle: egg - adult

Unknown portion

Known portion

Total for the species

---

**Estimate of PMI using ADH**

**Body found**

- April 28 2230 - 0000
- April 27 2400 - 0000
- April 26 2400 - 0000
- April 24 2400 - 2300

**22.5 hours of dev't**

- Mean Temp = 23°C
- 23 ADH / hour

<table>
<thead>
<tr>
<th>Data (°C)</th>
<th>Egg</th>
<th>Larva 1st Instar</th>
<th>Larva 2nd Instar</th>
<th>Larva 3rd Instar</th>
<th>Pupa</th>
<th>Pupa Total Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucilia sericata</td>
<td>21</td>
<td>31</td>
<td>26</td>
<td>20</td>
<td>116</td>
<td>240</td>
</tr>
<tr>
<td>Lucilia cuprina</td>
<td>20</td>
<td>33*</td>
<td>33*</td>
<td>24</td>
<td>114</td>
<td>324</td>
</tr>
<tr>
<td>Calliphora stygia</td>
<td>24</td>
<td>46</td>
<td>24</td>
<td>20</td>
<td>36</td>
<td>324</td>
</tr>
<tr>
<td>Calliphora augur</td>
<td>24</td>
<td>24</td>
<td>20</td>
<td>16</td>
<td>336</td>
<td>23</td>
</tr>
<tr>
<td>Chrysomyia rufifacies</td>
<td>24</td>
<td>26</td>
<td>26</td>
<td>27</td>
<td>168</td>
<td>117*</td>
</tr>
<tr>
<td>Hydrotaea rostrata</td>
<td>48*</td>
<td>60*</td>
<td>60*</td>
<td>56*</td>
<td>144</td>
<td>324</td>
</tr>
</tbody>
</table>

---

**Estimate of PMI using ADH**

**Body found**

- October 15 0900 - 0000
- October 14 2400 - 0000

**Further into past**

- Present

**Mean Temp = 20°C**
- Mean Temp = 21°C
- Mean Temp = 20°C

**43.5/23 = 1.9 hrs**

**12:00 a.m. – 1.9 hrs**

**= ~2206 hrs**

---

Data from Anderson (2000)

**isomegalen diagram for Phaenicia (= Lucilia) sericata**

8 mm maggot

24 C daily max.

16 C daily min.
**estimate of PMI using ADH**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Insect Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>Blow flies and flesh flies; adults feed &amp; deposit eggs in body openings; fly predators</td>
</tr>
<tr>
<td>Bloated</td>
<td>Blow flies in great numbers; some muscids and ants which feed on larvae</td>
</tr>
<tr>
<td>Decay</td>
<td>Dipteran larvae predominate, complete development; beetles feed on dry tissue; rove beetles, histerids</td>
</tr>
<tr>
<td>Post-decay</td>
<td>Beets dominant. Dermestids, rove beetles, histerids, fly pupae. In wet habitats, moth flies, sphaerocerids and muscids, rove beetles</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Few insects left; some dermestids, histerids, fly pupae, rove beetles, normal soil fauna</td>
</tr>
</tbody>
</table>

9 hours of dev’t Mean Temp = 20°C 180 ADH 907.8-180 = 727.8
24 hours of dev’t Mean Temp = 21°C 504 ADH 727.8-504 = 223.8
Mean Temp = 20°C 20 ADH / hour 223.8/20 = 11.2 hrs 12:00 a.m. – 11.2 hrs = just before 1 p.m.

beetle larvae typically found later in succession. not too useful in PMI estimations – developmental data are lacking.

rules to live by…

- estimate is not PMI – it’s period of insect activity
- each case is unique
  - careful attention to all data & details

influences on development & succession

- geography, season, exposure to sun, urban vs. rural, location in buildings, burial, in water, in vehicle, burnt, wrapped, drugs, maggot masses

http://www.deathonline.net/decomposition/decomposition/black_putrefaction_c.htm