Time in a Bottle
What we have learned from a decade of Bottle Trapping

UTAH COUNTY MOSQUITO ABATEMENT
Equipment we used

- Trap Stands (two).
- Weather Station with stand.
- CDC CO₂ containers (two).
- Two John W Hock Company Collection Bottle Rotator Traps.
- Two 12-volt Batteries.
A Brief History

Started Trapping using the bottle trap in the summer of 2008.

One trap ran a 24-hour period from 8 am to 8 am the next day.

Three-hour intervals for each bottle.
2009 Data

2009 still only one trap but
Shifted times to reflect only
the evening hours from 8 pm
to 8:00 am.

With 1 hour and 15-minute
intervals for bottles 2 – 7.

With 1 hour and 30 minutes
for bottles 1 and 8.
2010 Data

2010 still only one trap but shifted times form 6:00 pm to 7:00 am.

With 6-8 pm being the 1st interval.

Then every hour until 2:00 am.

The last interval was 5 hours.
A major change occurred when we pick up a 2nd bottle trap. Started with 2-hour slot (6 pm to 8 pm).

Ran 30-minute intervals during the peak times 8:00 pm to midnight.

Then move the intervals to an hour for the rest of the night.

We have stayed with this format.

The data presented today uses these time intervals.
We added a weather station to track the local weather at the trap site. We collected the following each night:
- Relative pressure
- Temperature
- Humidity
- Wind speed and direction
- Wind gusts
- Rain totals

This was collected every 15 minutes and averaged into the time slots shown.

<table>
<thead>
<tr>
<th>Time</th>
<th>Relative Pressure</th>
<th>Temp F</th>
<th>Humidity %</th>
<th>Wind speed mph</th>
<th>Wind Direction</th>
<th>Wind Gusts</th>
<th>Rain Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 - 8:00 pm (1a)</td>
<td>29.81</td>
<td>92.11</td>
<td>23.63</td>
<td>1.34</td>
<td>NNW</td>
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<tr>
<td>8:00 - 8:30 pm (2a)</td>
<td>29.82</td>
<td>80.65</td>
<td>48.00</td>
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<td>N</td>
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<td>29.82</td>
<td>76.30</td>
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<td>N</td>
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<tr>
<td>9:00 - 9:30 pm (4a)</td>
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<td>56.50</td>
<td>0.20</td>
<td>ESE</td>
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<td>51.50</td>
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<td>ENE</td>
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<td>11:00 - 11:30 pm (8a)</td>
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<td>62.80</td>
<td>44.00</td>
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<td>E</td>
<td>0.65</td>
<td>0.00</td>
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<td>60.90</td>
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<td>ESE</td>
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</tbody>
</table>
Some total Trap Numbers

This should give you an idea of the magnitude of this project

- Total Mosquitoes trapped 372,272
- Greatest species trapped Cx. pipiens 107,881
- Least species trapped Co. peturbans 188
- Time intervals with the most mosquitoes active was 9:00-10:00 pm 106,106 or 28.4% of the mosquitoes trapped
- The data presented represents 9 years of trapping

<table>
<thead>
<tr>
<th>Flight Time</th>
<th>Ae. vexans</th>
<th>Oc. dorsalis</th>
<th>Oc. inverpictus</th>
<th>Oc. nigromaculis</th>
<th>An. freeborni</th>
<th>Cx. erythorothorax</th>
<th>Cx. pipiens</th>
<th>Cx. tarsalis</th>
<th>Cs. Inornata</th>
<th>Co. peturbans</th>
<th>All Species</th>
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<tbody>
<tr>
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<td>351</td>
<td>1461</td>
<td>60</td>
<td>5</td>
<td>4262</td>
<td>734</td>
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<td>478</td>
<td>1</td>
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<td>3673</td>
<td>1625</td>
<td>498</td>
<td>131</td>
<td>9774</td>
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<td>213</td>
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<td>3272</td>
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<td>20</td>
<td>1805</td>
<td>6932</td>
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<td>1467</td>
<td>3</td>
<td>15034</td>
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<td>217</td>
<td>71</td>
<td>27</td>
<td>1275</td>
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<td>178</td>
<td>217</td>
<td>71</td>
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<td>1275</td>
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<td>3:00 - 3:30 am (5b)</td>
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<td>207</td>
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<td>2417</td>
<td>937</td>
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<tr>
<td>3:30 - 4:00 am (6b)</td>
<td>66</td>
<td>99</td>
<td>207</td>
<td>53</td>
<td>14</td>
<td>1038</td>
<td>4484</td>
<td>2417</td>
<td>936</td>
<td>4</td>
<td>9317</td>
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<tr>
<td>4:00 - 4:30 am (7b)</td>
<td>82</td>
<td>114</td>
<td>297</td>
<td>34</td>
<td>10</td>
<td>771</td>
<td>3454</td>
<td>1840</td>
<td>678</td>
<td>2</td>
<td>7281</td>
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<tr>
<td>4:30 - 5:00 am</td>
<td>81</td>
<td>113</td>
<td>262</td>
<td>34</td>
<td>10</td>
<td>765</td>
<td>3425</td>
<td>1747</td>
<td>662</td>
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<td>118</td>
<td>930</td>
<td>339</td>
<td>50</td>
<td>22</td>
<td>795</td>
<td>2081</td>
<td>1493</td>
<td>646</td>
<td>0</td>
<td>6475</td>
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<td>5:30 - 6:00 am</td>
<td>117</td>
<td>933</td>
<td>340</td>
<td>50</td>
<td>24</td>
<td>651</td>
<td>2058</td>
<td>1529</td>
<td>626</td>
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<td>68</td>
<td>572</td>
<td>246</td>
<td>40</td>
<td>13</td>
<td>532</td>
<td>445</td>
<td>403</td>
<td>136</td>
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<td>6:30 - 7:00 am</td>
<td>40</td>
<td>572</td>
<td>245</td>
<td>40</td>
<td>17</td>
<td>532</td>
<td>445</td>
<td>403</td>
<td>136</td>
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<td>Total Caught</td>
<td>5136</td>
<td>23276</td>
<td>14214</td>
<td>4974</td>
<td>717</td>
<td>81420</td>
<td>107881</td>
<td>93128</td>
<td>42338</td>
<td>188</td>
<td>373272</td>
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</tbody>
</table>
Findings

Some general findings with 10 species being represented:
- Majority of flight time is from 8:00 pm to 11:00 pm for most species.
- Mosquitoes tend to not fly when temperatures are below 50 degrees F.
- Wind speeds above 5 mph will reduce the number of mosquitoes flying.
All species stacked by flight time
Flood Water Species

Have a very narrow flight window

- At 8:30 to 9:00 pm.
- Oc. nigromaculis only 30 minutes.
- Oc. dorsalis has a bump at 5:00 am.
Permanent Water Species

Broader flight times
- Some appear all over the place
  - Cs. Inornata.
  - Cx. pipiens have interesting late spike with broad flight time.
Digging a Little Deeper into the Data

A question was asked about mosquito flight time as it related to sunset towards the end of the summer.

We had the information to answer the question we just needed to dig it out.
Sunset times Utah County

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-May</td>
<td>7:26 PM</td>
</tr>
<tr>
<td>4-Jun</td>
<td>7:26 PM</td>
</tr>
<tr>
<td>24-Jun</td>
<td>7:26 PM</td>
</tr>
<tr>
<td>14-Jul</td>
<td>7:40 PM</td>
</tr>
<tr>
<td>3-Aug</td>
<td>7:55 PM</td>
</tr>
<tr>
<td>23-Aug</td>
<td>8:09 PM</td>
</tr>
<tr>
<td>12-Sep</td>
<td>8:24 PM</td>
</tr>
<tr>
<td>2-Oct</td>
<td>8:38 PM</td>
</tr>
</tbody>
</table>
Broke the Trap data into 5-time groups based on dates and sundown times.

<table>
<thead>
<tr>
<th>Period</th>
<th>Start Date</th>
<th>End Date</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1</td>
<td>May 28</td>
<td>June 25</td>
<td>14 days</td>
</tr>
<tr>
<td>Period 3</td>
<td>July 2</td>
<td>Aug 7</td>
<td>17 days</td>
</tr>
<tr>
<td>Period 4</td>
<td>Aug 12</td>
<td>Aug 28</td>
<td>9 days</td>
</tr>
<tr>
<td>Period 5</td>
<td>Sept 3</td>
<td>Sept 11</td>
<td>6 days</td>
</tr>
</tbody>
</table>

- **Period 1**: 8:30 to 9:00 pm, May 28 - June 25
- **Period 3**: 8:30 to 9:00 pm, July 2 - Aug 7
- **Period 4**: 8:00 to 8:30 pm, Aug 12 - 28
- **Period 5**: 7:30 to 8:00 pm, Sept 3 - 11
Looking at the 9 species over the sundown time groups

<table>
<thead>
<tr>
<th>Floodwater mosquitoes</th>
<th>Permanent water mosquitoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>◦ <em>Ae. vexans</em></td>
<td>◦ <em>An. freeborni</em></td>
</tr>
<tr>
<td>◦ <em>Oc. dorsalis</em></td>
<td>◦ <em>Cx. erythorothorax</em></td>
</tr>
<tr>
<td>◦ <em>Oc. increpitus</em></td>
<td>◦ <em>Cx. pипiens</em></td>
</tr>
<tr>
<td>◦ <em>Oc. nigromaculis</em></td>
<td>◦ <em>Cx. tarsalis</em></td>
</tr>
<tr>
<td></td>
<td>◦ <em>Cs. inornata</em></td>
</tr>
</tbody>
</table>
Ae. vexans

Flight time peaks are **30 minutes after sundown.**

Time period 2 is sporadic due to small sample size.

Data table shows shift.
**Oc. dorsalis**

Flight time **begins at sundown.**

Is limited to **about an hour.**

Has a **morning bump** at 5:00 am only species that seems to do this.
**Oc. increpitus**

No mosquitoes flew in period 5
Number decreased dramatically from period 1 to periods 2 - 4.

- **Period 1 had 5,508**
- Period 2 had 223
- Period 3 had 933
- Period 4 had 12
- Period 5 had 0

Makes period 1 most reliable.
Peak flight time at **30 minutes after sundown** but had activity from 6 to 10 pm.
Still followed the sundown pattern we have seen in other species.
**Oc. nigromaculis**

Flight time **began at sundown.**

Lasted **for 30 minutes.**

This is seen in the 2 through 5 time periods.

We do see a 5:00 am bump in the 1st and 4th time periods.

Follows sundown time very closely.
An. freeborni

Begins **flight time at sundown** or shortly there after.

Has a **longer if not all evening** flight time.

Temperature could be a major factor also in determining flight time.
Cx. erythorothorax

Flight time **within 30 minutes of sundown.**

Limited to **60-minute window.**

Time periods 3, 4 and 5 had large numbers collected.
**Cx. pipiens**

Began flight time **60 minutes after sundown.**

Flew for most of the evening with **a second peak around 11:30 pm.**

Had a shift to earlier flight during period 5. May be due to cooler evening temperatures causing them to fly earlier.

Primarily feed on **birds when roosting in the nighttime hours.**
**Cx. tarsalis**

Flight time **30 to 60 minutes after sundown.**

At times will fly late into the evening as seen in period 2.

Most of the **time finish flying within the hour** of beginning flying.
Cs. inornata

Begins flight time **30 to 60 minutes past sundown.**

Has several peaks during the night.

**Seem to fly all night.**
What does this mean for mosquito control then?

- Time you spray for adults is critical if you are targeting a specific species. nigromaculis vs picipens
- Allows for more pointed and specific control by targeting spray time. (No a.m. Spraying)
- Better use of resources chemicals and manpower
- Great PR tool if you can communicate all this to the public. Helps them understand why you are spraying.
Thanks to

Utah County Mosquito Abatement

Utah County Health Department

All the mosquitoes that found our traps enticing
Any Questions