Piloting citizen science to monitor the fireflies in Kuala Selangor Nature Park (KSNP), Malaysia

Wong Choong Hay
(Malaysian Nature Society)
1. Citizen science
2. KSNP fireflies
3. Objectives of a firefly monitoring study
4. Monitoring methods
5. Testing
6. Findings
7. Lessons learnt/ feedback
8. Way forward
9. Conclusion
1. Citizen science
Individual volunteers in science, a long tradition in UK (Tweddle et al 2012) especially in ornithology (Greenwood 2007).

As for firefly, the long term data collection is the UK Glowworm project & a few other countries….

….a recent paper by De’Cock & Ramon 2013 on guidelines on how to plan survey and monitor study specifically for fireflies.
Well planned and executed, it increased science knowledge, raise awareness, engagement tool for like minded person to share enthusiasm and knowledge; must be enjoyable and volunteers satisfied spending their leisure time for a purpose.

At the moment this project is under the development stage - test and modify before implementation.
2. KSNP fireflies
State of Selangor

East Asian – Australasian Flyway

MY11 North-central Selangor coast

Kuala Selangor

Sekinchan

Bukit Fraser

Kapar

Petaling Jaya
Zone of Protection (Declared) Area and Restriction for the Sungai Selangor synchronous firefly

Kuala Selangor Nature Park - non- synchronous firefly
• 324 ha: coastal mangroves, secondary forest, brackish lake, freshwater canal
• mudflats
the fireflies

roving firefly

two non-synchronous firefly
3. Firefly monitoring study
2011 : bringing back water birds to KSNP lake
- original purpose of the lake now overgrown
- future closure of coal power plant ash pond

Flood lake with seawater to rid of vegetation & creating mudflats in the lake

The increase in salinity.
- Will it affect / change the firefly habitat?

Objective: provide baseline data for any changes to the firefly and determine monitoring methods for the public.
4. Monitoring methods
Non-invasive method

- Count twice monthly (+/- moon) over 13 months

- Note behaviour, habitat, timings, environmental factors, trees,.....

- ID trees, tag, GPS, map

- Develop a firefly module for the test run - two Februarys & compare

- Fine tune module
Kuala Selangor Nature Park (KSNP)’s Biodiversity Module: Firefly

developed by
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‘Pioneer Module Development Programme’

firefly monitoring module for test runs by UKM students

firefly module and reference book developed later
Test run with UKM students Feb 2012 & Feb 2013 (10 days)

Training:
2 hour lecture – fireflies, survey & GPS use
3 hour field techniques

Assignment:
Time: ~7.30-9.30pm daily (cancel if the rain stops after 9pm)
For congregating fireflies:
  1. Map display trees & larva site & count adult and larva
  2. Observe daily population from chosen trees.
  3. Observe behaviour, environmental factor, predator, wildlife,…
For roving firefly:
  1. Map range of adult and larva and count; behaviour

Report and Presentations: feedback/ improvement
equipment

• GPS
• data sheet/notebook
• ribbon tags
• slim clear box + 1mm grid graph paper
• macro camera
• bottle with 70% alcohol + label for dead firefly
• aerial net
• torch
Date: 1/2/12 Time: start 7.45 pm end 10 pm; Cancelled (if rain does not stop after 9pm)
Environmental factors: (temperature, wind, humidity, weather, clouds, lights, etc)
29 c; warm, very humid, no wind, cloudy, night glow
Moon phase: please draw

### Main Trail (1&5):

<table>
<thead>
<tr>
<th>Walk</th>
<th>Firefly 1 light colour:</th>
<th>Firefly 2 light colour:</th>
<th>Walk back</th>
<th>Firefly 1 light colour:</th>
<th>Firefly 2 light colour:</th>
<th>Rovers (M/F/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out</td>
<td>whitish</td>
<td>yellowish</td>
<td>Back</td>
<td>whitish</td>
<td>yellowish</td>
<td>Male 1 N E</td>
</tr>
<tr>
<td>Adult</td>
<td>M F 2</td>
<td>M F 2</td>
<td>Adult</td>
<td>M F 1</td>
<td>M F</td>
<td></td>
</tr>
<tr>
<td>Larva</td>
<td>R 7 L 15</td>
<td>R L 5</td>
<td>Larva</td>
<td>R 11 L 6</td>
<td>R 4 L</td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td>notes</td>
<td>Seen 3 on plants 1m high</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Tower Trail (2 & 3):
<table>
<thead>
<tr>
<th>Waypoint</th>
<th>S x</th>
<th>Coordinates</th>
<th>tree name</th>
<th>adult</th>
<th>Larva</th>
<th>Light colour</th>
<th>Waypoint</th>
<th>S x</th>
<th>Coordinates</th>
<th>tree name</th>
<th>adult</th>
<th>Larva</th>
<th>Light colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>015</td>
<td>N E</td>
<td>acacia</td>
<td>25</td>
<td>Whitish</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015</td>
<td>N E</td>
<td>?</td>
<td>2 atas pokok 3 m</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

Rovers: 2 male N

Notes: Download GPS of new tree. Data transfer to excel. Create daily distribution map.
5. Testing
## Data recording

<table>
<thead>
<tr>
<th>Coordinates</th>
<th>Tree name</th>
<th>adult</th>
<th>Larva</th>
<th>Light colour</th>
<th>Way point</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 44.9″</td>
<td><em>Pittosporum</em> robustum</td>
<td>3</td>
<td></td>
<td>Yellow 013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 44.9″</td>
<td><em>Pitrosa</em> arcuata</td>
<td>4</td>
<td></td>
<td>Green 015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 44.9″</td>
<td><em>Mutisya</em> albida</td>
<td>5</td>
<td></td>
<td>Yellow 016</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 44.9″</td>
<td><em>Areca</em></td>
<td>2</td>
<td></td>
<td>Yellow 017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 35.6″</td>
<td><em>Helminthostachys</em></td>
<td>12</td>
<td></td>
<td>Yellow 017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 35.6″</td>
<td><em>Hibiscus</em></td>
<td>3</td>
<td></td>
<td>Yellow 018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 35.6″</td>
<td><em>Coelostoma</em></td>
<td>5</td>
<td></td>
<td>Yellow 019</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 35.6″</td>
<td><em>Sonneratia</em></td>
<td>6</td>
<td></td>
<td>Yellow 021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 35.6″</td>
<td><em>Apia</em></td>
<td>22</td>
<td></td>
<td>Yellow 022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 0° 30′ 30.40″ E 101° 14′ 29.3″</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Notes**

UKM
6. Findings
Habitat #1
*Pyrocoelia*

main trail - secondary forest & forest fringe along the canal and lake trail.
Habitat #2
non-synchronous firefly, *Pteroptyx*
displaying high on tall mangrove trees along the coastal bund.
Habitat #3

non-synchronous firefly *Colophotia*

on secondary forest trees like *Sea Hibiscus, Acacia*, along the lake trail and canal.....&...
Tower trail overlooking lake
Observations #1 *Pyrocoelia*

Emerge after sunset till early morning

sometimes docile after sunset

Nagaraj/MNS 2.13am

Nagaraj/MNS 12.21am

Nagaraj/MNS 7.50pm

Nagaraj/MNS 8.01pm
Light trail of *Pyrocoelia*
Liew Weng Keong/MNS
Observation #2
Pteroptyx valida

Bright slow non-synchronous flashing high up on the tall Brugueria cylindrica
Whitish green
Observation #3
Dominant – *Colophotia praeusta*

Emerge about half hour after sunset
Fly blinking straight up trees from vegetation / earth below
…sometimes 15-30 min. before flashing non-synchronous &
do move about in the canopy before settling
Greenish-Yellow
congregating fireflies on display trees around the lake.

© Liew Weng Keong/MNS
Lighthouse & night glow
Larva feeding on another unidentified larva

Early mating pair just after dusk observed; mate on the ground

Larva on plants
Ant attack

10.27pm

10.29pm  Nura Amalina/UKM
Spider attack

9.15pm

Siti Munirah Abdul Hamid/ UKM

10.06pm

11.06pm
Other glowing organisms

*Dyakia striata* land snail

*Filoboletus manipularis*

…and including two other type of bioluminescent fungus and dinoflagellates in the lake
Samples of firefly distribution map 2011-2013
Individual fireflies flying along the main trail forest and open areas; larvae in different instars along the trail.

Pteroptyx and Diaphanes Colophonia females in the grassy bunds and landing along the Eastern Bund Trail.

Only three firefly trees observed @ 22 Oct 2011.
Moonlight started

Early Mating

Glowing Snail

Strange constant stationary flashing

Heard Nightjar

23 January 2013

Kera

Big Pyrocoelia larva

Kuala Selangor Nature Park

Rope Bridge to trails

Nature Trail Park

Mangrove Forest Walkway
Firefly trees around the lake

1997 *P. valida*

2006 onwards *C. praeusta*

February 2012 *P. valida* (west bund)

February 2013 north, east and tower reduced and diminished
Comparing Feb 2013 & Feb 2012 (UKM) shows a similar congregating firefly habitat range seemed quite stable

- except North bund - one tree remained at NW corner.
- South- more display trees behind than along trail
- West- more display trees & areas which had none.
- more *Pyrocoelia* seen on the E. & S. in 2013
- more larva seen on the E. and S. in 2013.
dry months

- Congregating fireflies much reduced except for few popular trees even some popular trees did not recover eg 032.

- Tower congregating fireflies population declined since May 2012

- *Pyrocoelia* not much affected in Main Trail

7.31pm
7. Lessons learnt / feedback

Technique
• reduce wordings in module
• improve tagging location, material & ink
• improve counting method to reduce bias
• knowledge of GPS error
• count the trees along the trail not behind/ opposite

Volunteers
• safety (walkie talkie, first aid, humidity- equipment)
• resources (training, supervise, budget, time)
• good eyesight & not afraid of the dark
8. Way forward

• Improve, adapt changes to ensure data quality

• Test with other groups eg community, schools

• Collaboration with institutions

• Contributory S.C. now- aim for a collaborative approach to get inputs, involvement & long term commitment by volunteers
9. Conclusion

• Only a one year comparison, there are some noticeable changes in firefly distribution.

• Need an understanding of changes and the causing factors

• Monitoring methods is simple enough for amateurs to supply adequate data
Thanks to my colleagues & friends, KSNP, UKM, FRIM’, Andy Paul, Maureen, Liew Weng Keong, Lesley Ballantyne, Raphael De’Cock for their support.

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Photos credit: Wong Choong Hay, Nura Amalina, Siti Munirah Abdul Hamid, Liew Weng Keong, Raphael De’Cock

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