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Title
Relative Abundance of Coleoptera and Lepidoptera

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CENS
Center for Embedded Networked Sensing

Relative Abundance of Coleoptera and Lepidoptera
Temporal Variation in Relation to Temperature and Humidity

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Study Location: James Reserve (www.jamesreserve.edu)

Introduction: Design a biological study that utilizes NIMS camera technology.

Biological Goals

- Observe how *temperature* and *humidity* affect the relative abundance of Coleoptera (beetles) and Lepidoptera (moths).
- Determine the *average residence time* of an insect visiting the light trap.
  - *Problem 1*: How is an insect visit defined?
    Solution 1: A visit occurs when an insect comes to a complete stop in the area of the light trap.
  - *Problem 2*: What is the average residence time?
    Solution 2: Use direct observation of how long each insect stays in the area of the light trap to calculate an average residence time for both insect types.

Technological Goals

- Design a simple biological study that can utilize *NIMS camera technology*.
  - How often does a photograph need to be taken for an accurate sample?
  - Provide future challenges to programmers and engineers such as using *adaptive sampling* to capture images of newly arrived insects and to design a search image able to identify the insects.
- Construct a *light trap* to collect data on relative abundance using the NIMS camera.
  - What materials and lighting should be used to construct the trap?
  - How will enough light be generated to get images that can be used for identification?

Questions:
Biology: How will relative abundance change due to variation in temperature and humidity.

Technology: How will the NIMS camera provide an accurate sample of the relative abundance of Coleoptera and Lepidoptera?

Hypothesis

Biology: The relative abundance of Coleoptera and Lepidoptera will increase with temperature and have little or no correlation with humidity.

Technology: Capturing an image of the light trap every five minutes from 9 PM to 5 AM nightly will provide an accurate and sufficient sample of relative abundance. Information on temperature and humidity can be obtained from the Trailfinder Weather Station.

*I am hyperactive and scare away other insects !*

Results: The technological design provides accurate and sufficient data on the relative abundance of Coleoptera and Lepidoptera at the James Reserve.

Biological Results:

Relative Abundance of Coleoptera vs. Temperature (°C)

• Strong correlation is shown between temperature and relative abundance of Coleoptera.

Relative Abundance of Coleoptera vs. Percent Humidity

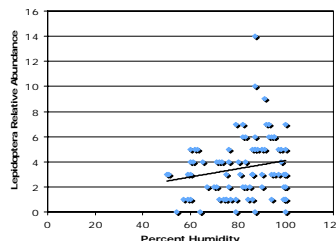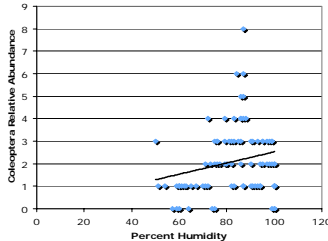• Weak correlation is shown between relative abundance of Coleoptera and humidity.
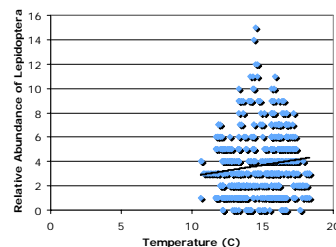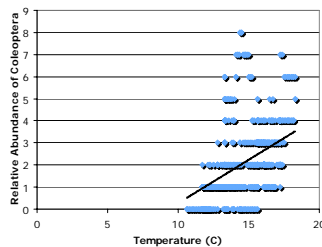
Relative Abundance of Lepidoptera vs. Temperature (°C)

• Weak correlation is shown between temperature and relative abundance of Lepidoptera.

Relative Abundance of Lepidoptera vs. Percent Humidity

• Weak correlation is shown between relative abundance of Lepidoptera and humidity.

Technological Results:

• Based on direct observation of the light trap the average residence time of Coleoptera and Lepidoptera is 34 minutes and 36 minutes respectively. Insects rarely move once settled, unless disturbed by other insects. This data signifies that capturing an image of the light trap every five minutes is a sufficient sample to determine relative abundance of insects.

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