Viewing specimen data through the prism of collecting events

Benefits of “Collecting Event First” Databasing Approaches

Andrew Short

KU BIODIVERSITY INSTITUTE
The University of Kansas
What is a Collecting Event?

A unique combination of collection data

Example: Locality+Date+Habitat+Method
What is a Collecting Event?

A unique combination of collection data

**Example:** Locality+Date+Habitat+Method
What is a Collecting Event?

A unique combination of collection data

Example: Locality + Date + Habitat + Method

COSTA RICA: Cartago Prov. Tapanti National Park, Rio Orosi, kicknetting, leg. A. Short [Some GPS, etc.], 12.v.2009 CR09-0512-03A
Approaches

**Specimen Based:** Data attached to Specimens

**Event Based:** Specimens attached to Data
Specimens vs Events

Specimen-based approach: This event never happened!
Tropisternus lateralis
Tropisternus lateralis
Example:

Smithsonian Aquatic Beetle Collection

c. 1.5 million specimens
Starting Point: Specimen Based Approach
Starting Point: Event Based Approach

P. J. Spangler

Field notes for ca. 40 expeditions [1952-1995]
Step 1: Scan Notes

PJS-V2-860224-1

DATE: 24 Feb. 86

LOCALITY: County: V

State/Dept.: T.F.A.

City:

Latitude: 0°

Longitude: 0°

Kilometers NW: 40

River/Brook name:

Collectors: PGS

COLL’N METHOD: Direct; seine; biklite; biklite trap; flight trap; malaise; pitfall trap

HABITAT: Stream; pond; lake; roadside ditch; rut in road; spring seepage; waterfall; in brennland; brackish pool; mineral water pool; hot spring; crab hole; side pool of stream; steep bank; stock tank; swim pool; woodland pond; pothole; culvert; (leaf packs) wet wood; other

AIR TEMPERATURE: 1 G

WATER TEMPERATURE: 19 G

PH: 5

OXYGEN: 12

DEG. HARDNESS: 0

TURBIDITY: CLEAR

ALTITUDE: ft/m

DEPTH: 4

WIDTH: 3

VELOCITY: 0.5

SHADED - SUNNY

SUBSTRATA: Mud; gravel; sand; peasty; leafy; boulders; other

SOIL COLOR: Red; yellow; black; brown.

PLANT ASSOCIATES: Alisma; Alternanthera; Anacharis; Azolla; Brasenia; Chara; Cephalanthus; Elodea; Eleocharis; Bibliaus; Hydrilla; Isoetes; Jussieae; Lemma; Ludwigia; Marsilea; Mougeotia; Myriophyllum; Nitella; Ranunculus; Riccia; Ruppia; Sagittaria; Selvinia; Scirpus; Spicigera; Taxodium; Typha; Tiapa; Utricularia; Wolffia; other

ANIMAL ASSOCIATES:

Adults: Several genera of Elmids; 1 sp. of N. Family: Lutobuna

?! small convex (presumably hydropodid) (?) hydroidic (other way)

Several genera of Teredinidae.

1 small schist in small pool at shoreline in other glass vial with

the N. Family! along w/ tiny hydroidic larvae & other tiny stuff.

Larvae: Numerous larvae

EST. # HOURS: 100+

Actual - 216
Step 2: Assign & Stamp Coll Event #s

PJS-VZ-860224-1
Step 2: Assign & Stamp Coll Event #s

Collector: PJS

Date: 24 Feb 86

Country: V

Event: PJS-VZ-860224-1

Habitat: Stream; pond; lake; roadside ditch; rut in road; spring seepage; waterfall; in brounial; brackish pool; mineral water pool; hot spring; crab hole; side pool of stream; steep bank; stock tank; swim pool; woodland pond; pothole; culvert; (tree packs) wet wood; other

Air Temperature: 45 C

Water Temperature: 17 C

Oxygen: 12

Depth: 5

Width: 3

Velocity: 10

Substrate: Mud; gravel; sand; peaty; leafy; brackish; other

Soil Color: Red; yellow; black; brown

Plant Associates: Allama; Alternanthera; Anacharis; Arolla; Brasenia; Chara; Capillary; Elorhiza; Eleocharis; Bibliion; Hydriodenium; Isoetes; Jusea; Lema; Ludwigia; Marisalia; Menegosa; Myriophyllum; Nitella; Nyphaea; Pluck; Polygonum; Potamogeton; Pseudopinnae; Linnunculus; Rhizophora; Rhus; Rupia; Segneria; Selvinia; Scirpus; Spicula; Taxodium; Typha; Trapa; Utricularia; Wolffia; other

Animal Associates: Adults; Several genera of Elmis; 1 sp. of N. Family; Lutheae

Small convex (broadin like?); Hydrophilid; H. Hydroscyca; Several genera of Trichodactylidae;

1 is dad in small pool at shoreline in other glass vial with the family along with tiny hydrophilid larva & other tiny stuff

Larvae: Numerous larvae

Estimated # Individuals: 100+ Actual: 216
KENYA

Nyeri

Kuwait - 19
Alcohol

Nyeri

Hypenope - 1
Colop - 58

P.J. Spangler

II-4-68
Blacklite

P.J. Spangler

I-4-68
Kronbeirn

P.J. Spangler

PJS-KE-680204-5

KENYA

Aquatica - stream

Nyeri

Approx. - 125

II-4-68, stream

P.J. Spangler

PJS-KE-680204-6

KENYA

Nyeri - 13

Thika, II-4-68

Colop - 2

15

P.J. Spangler

PJS-KE-680205-1

KENYA

Specheo - eggs, Helochares Eggs

Enochromis, Copeia, Rhantus

Acthebus, Saccopilus, Biddamsa

Hygrota, Regimbartia, Sacciside

PJS-KE-680205-2

Burguret River - Rhantus

Nanyuki

Biddamsa, Enochromis, Helochares

Octhebus, Elmide, Bembidea

PJS-KE-680205-3

KENYA

Roadside seepage area

PJS-KE-680205-4

KENYA

Hypenope - 10 (4 - nymphal)

P.J. Spangler

Nanyuki

Hypenope - 9

Colop - 11

PJK

PJS-KE-680205-5

Dodonata - 7

Nanyuki

Hypenope - 3

P.J. Spangler
PJS-KE-680204-1

KENYA
Nyeri
1-4-68
blacklite
Spangler

PJS-KE-680204-5

PJS-KE-680204-2

PJS-KE-680205-3

PJS-KE-680204-6

PJS-KE-680205-4

PJS-KE-680205-5
### Step 3: Digitize Data + QC

<table>
<thead>
<tr>
<th>Code</th>
<th>Start Date</th>
<th>Country</th>
<th>State</th>
<th>City/ Locality String</th>
</tr>
</thead>
<tbody>
<tr>
<td>PJS-VZ-860219-1</td>
<td>19.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860220-1</td>
<td>20.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Gavilan, 37 km SE of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860220-2</td>
<td>21.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Gavilan, 35 km SE of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860220-3</td>
<td>21.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>15 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860220-4</td>
<td>21.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>29 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860222-1</td>
<td>22.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860222-2</td>
<td>22.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860222-3</td>
<td>22.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860222-4</td>
<td>22.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860222-5</td>
<td>22.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860222-6</td>
<td>22.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860223-1</td>
<td>23.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860223-2</td>
<td>23.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860223-3</td>
<td>23.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860223-4</td>
<td>23.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860223-5</td>
<td>23.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860223-6</td>
<td>23.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860224-1</td>
<td>24.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860224-2</td>
<td>24.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860224-3</td>
<td>24.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860224-4</td>
<td>24.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860224-5</td>
<td>24.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860224-6</td>
<td>24.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860225-1</td>
<td>25.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860225-2</td>
<td>25.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860225-3</td>
<td>25.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860225-4</td>
<td>25.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860225-5</td>
<td>25.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860225-6</td>
<td>25.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860226-1</td>
<td>26.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860226-2</td>
<td>26.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860226-3</td>
<td>26.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860226-4</td>
<td>26.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860226-5</td>
<td>26.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860226-6</td>
<td>26.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860227-1</td>
<td>27.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860227-2</td>
<td>27.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860227-3</td>
<td>27.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860227-4</td>
<td>27.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860227-5</td>
<td>27.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860227-6</td>
<td>27.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860228-1</td>
<td>28.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860228-2</td>
<td>28.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860228-3</td>
<td>28.ii.1986</td>
<td>Venezuela</td>
<td>Amazonas</td>
<td>Tobogan, 40 km S of Puerto Ayacucho</td>
</tr>
<tr>
<td>PJS-VZ-860304-1</td>
<td>04.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860305-1</td>
<td>05.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860305-2</td>
<td>05.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860305-3</td>
<td>05.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860306-1</td>
<td>06.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860306-2</td>
<td>06.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860306-3</td>
<td>06.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860306-4</td>
<td>06.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860307-1</td>
<td>07.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860307-2</td>
<td>07.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860308-1</td>
<td>08.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860308-2</td>
<td>08.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860309-1</td>
<td>09.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
<tr>
<td>PJS-VZ-860309-2</td>
<td>09.iii.1986</td>
<td>Guárico</td>
<td>Vargas</td>
<td>Guárico</td>
</tr>
</tbody>
</table>

**Code**: Identification code for the specimen.

**Start Date**: Date when the specimen was collected.

**Country**: Country where the specimen was collected.

**State**: State within the country where the specimen was collected.

**City/ Locality String**: Specific locality information.
Step 3: Digitize Data + QC

Note: we use a remarks field to record “original errors” & label/note discrepancies
Step 4: Georeference as necessary
Step 4: Georeference as necessary

BONUS: Digitizing by expedition increases precision
SPANGLER LEGACY PROJECT
P. J. SPANGLER FIELD NOTE SCANS

The attached PDF is a scan of original field documentation for collections of insects made by Paul and Phyllis Spangler, past curator of Coleoptera at the US National Museum of Natural History, Smithsonian Institution, or their associates.

Scanning procedures
Grayscale scans of the original field notes and logs were made at resolutions of 300, or more frequently, 600 DPI. The reverse sides of all field notebook pages were scanned regardless of whether they were used or blank (often, an approximate list of specimens was written on the backs of the pages once the sample was sorted). Loose pieces of paper and other inserted notes (if present) were scanned and placed as front matter in each expedition PDF. Original scans have been archived; this PDF has been optimized to reduce file size.

Collecting Event Codes
Each identifiable, discrete collecting event has been assigned a unique identifier to facilitate cross-referencing and databasing efforts. This code has been stamped in the upper left of each field note page (front and back). These codes are standardized by incorporating the country abbreviation and the date of collection. If more than one event occurred on the same day, these are numbered sequentially (in chronological order if that order is evident). For example, the third discrete collection event for 17 June 1967 in Costa Rica would be automatically formulated as PJS-CR-670617-3. Please note that separate collecting events do not signify different localities, but a unique combination of data as decided by the Spangers at the time.

Accuracy
These notes were scanned as they were received from the Spangers. They have not been altered, corrected, or verified. As with any field notes, they contain occasional errors such as place-name misspellings, etc. When detected, these are corrected in the database file during transcription.

Additional Information
The core information for each collecting event (locality information, date, collectors, habitat, method of collection) has been transcribed and edited in a separate master database file. The majority of events have been georeferenced and covered into KML files. These files are available upon request.

This document was scanned, edited, and annotated in the Short Lab at the University of Kansas
Department of Ecology & Evolutionary Biology & Biodiversity Institute
About the Digitization Process: [Download PDF]

Master KML file
Version 1.0: 10 May 2011 [Download KMZ file here]

Master Excel file
Version 1.0: 10 May 2011 [download .xml format]/ [download .xlsx format]

Original Field Note Scans (PDF format) (branded with retroactive collecting event numbers)
[Note: You can sort this list by column]

Showing 44 items
Step 5: Associate scans in database
Step 6: Associate Specimens
## Actual Label:

<table>
<thead>
<tr>
<th>VENEZUELA, Guar.</th>
<th>Calabozo (40 km S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hato Masaguaraal</td>
<td>5 March 1986</td>
</tr>
<tr>
<td>PJSpangler, colln#24</td>
<td>PJS-VZ-860305-?</td>
</tr>
</tbody>
</table>
### Search For Event

<table>
<thead>
<tr>
<th>Not</th>
<th>Operator</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coll Event # Contains 860305</td>
</tr>
<tr>
<td>Call Event #</td>
<td>Entry #</td>
<td>Start Date</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>PJ-S-VZ-860305-1</td>
<td>23</td>
<td>03/05/1986</td>
</tr>
<tr>
<td>PJ-S-VZ-860305-2</td>
<td>24</td>
<td>03/05/1986</td>
</tr>
<tr>
<td>PJ-S-VZ-860305-3</td>
<td>25</td>
<td>03/05/1986</td>
</tr>
<tr>
<td>PJ-S-VZ-860305-4</td>
<td>26</td>
<td>03/05/1986</td>
</tr>
</tbody>
</table>
VENEZUELA, Guar.
Calabozo (40 km S)
Hato Masaguuaral
5 March 1986 PJSpangler
colln#24
**DATE:** 5 Mar 86  
**COLLECTION #:** 24  
**TIME:** 0915  
**LOCALITY:** VENEZUELA, Guar./Calabozo (40 km S)/Hato Masaguaral/ 5 March 1986/ PJSpangler/ colln#24  

**COLLECTORS:** PJSpangler  
**PHOTO:** No  
**COLL METHO:** Lift net swim. bislique. bislique trap flight trap nettiage  
**HABITAT:** Stream. pond. lake. roadside ditch. cut in road. spring seepage. waterfall. in bromeliad. brackish pool. mineral water pool. hot spring. crab hole. side pool of stream. stockpond. stock tank. swim pool. woodland pond. pothole. culvert. leaf packs. wet wood. other.  
**AIR TEMPERATURE:** 81°F  
**WATER TEMPERATURE:** 81°F  
**OXYGEN:** 3  
**PH:** 7  
**HARDNESS:** 20  
**TURBIDITY:** Clear  
**ALTIMETRY:** ft/m  
**DEPTH:** 15 m  
**WIDTH:** 100 m  
**VELOCITY:** 0 ft/sec.  
**SHADY**  
**SUNNY**  

**SUBSTRATUM:** Mud: gravel: sand: peaty: leafy: boulders: other.  
**SOIL COLOR:** Red: yellow: black: brown.  


**ANIMAL ASSOCIATES:** Incredibly rich!  

**HEMIPTERA**  
- Belostomatid Hydrib nymph  
- Notonemioid Neocorvinae  
- Corixidae Hydrib nymph  
- Placida  
- Corixidae Microvelia  

**DIPTERA**  
- Hydrochus  
- H. lacazei  
- H. lacoccinum  
- Macrophyllus  
- Desmopachria  
- Bidessodes  
- Microbidessodes  
- Notonemius  
- Helodid  
- H. tuberculatus  
- Microvelia  

**EST. # SPMS:** 5460  

*In 2 plastic bottles.*
All Events Assigned one of the following:

- Lotic
- Lentic (general)
- Lentic (riparian)
- Hygropetric
- Phytotelmata
- Non-Aquatic
- Passive Trapping
- Unspecified
### Bonus Step: Ecological Classification

<table>
<thead>
<tr>
<th>Habitat Classification</th>
<th>Country</th>
<th>Locality Name</th>
<th>Verrillae Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Costa Rica</td>
<td>Tapanti National Park, 9.6 km after scientific gate</td>
<td>Heliconia and small muddy roadside drainage area</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Costa Rica</td>
<td>Tapanti National Park, pipeline crossing</td>
<td>Heliconia inflorescences</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Costa Rica</td>
<td>San Ramon E8, San Ramon R8, 27 km N &amp; 8 km W San Ramon</td>
<td>Heliconia inflorescence</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Ecuador</td>
<td>Puyo</td>
<td>Heliconia</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Ecuador</td>
<td>Limoncocha</td>
<td>collected in Heliconia inflorescences</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Nicaragua</td>
<td>Matagalpa, 6 km N, Selva Negra Hotel</td>
<td>Heliconia fruits</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Nicaragua</td>
<td>Matagalpa, 6 km N, Selva Negra Hotel</td>
<td>Heliconia fruits</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Nicaragua</td>
<td>Matagalpa, 16 km N, Matagalpa-Jinotega Rd</td>
<td>Heliconia fruits</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Nicaragua</td>
<td>San Carlos, 60 km SE, Refugio Bartola</td>
<td>Heliconia fruits</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Panama</td>
<td>Cana Biological Station</td>
<td>Heliconia flowers</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Panama</td>
<td>Cana Biological Station</td>
<td>Heliconia &quot;flowers&quot;</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Panama</td>
<td>Barro Colorado Island</td>
<td>Heliconia firs.</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Panama</td>
<td>Barro Colorado Island</td>
<td>Heliconia firs.</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Panama</td>
<td>Barro Colorado Island</td>
<td>Heliconia firs.</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Peru</td>
<td>CICRA Field Station, trail 1, GS</td>
<td>Heliconia leaf roll</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Peru</td>
<td>Pakita, Troca Dos, Troca Dos</td>
<td>in dead leaves of Socrates palm flowers, along river, some aquatic and some terrestrial</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Suriname</td>
<td>Brownsberg Nature Preserve, Entrance Road</td>
<td>premontane tropical forest Heliconia flower bracts</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>United States</td>
<td>Mississippi Palisades State Park</td>
<td>flower blossoms</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>United States</td>
<td>Ogallala, 9 mi N</td>
<td>helicanthus</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Perija National Park, Tukuko, trail to Rio Manantial</td>
<td>mixed heliconia flowers</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Cerro Nebina</td>
<td>Brocchinia bremeliad</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Cerro Nebina</td>
<td>Brocchinia bremeliad</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Pico Periquitos, Rancho Grande Biological Station, Henri Pittier National Park</td>
<td>rolled leaves of Heliconia sp.</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Portachuelo Pass, Rancho Grande Biological Station, Henri Pittier National Park</td>
<td>Heliconia inflorescence</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>San Cristobol, 22.5 SE, Chorro El Indio National Park</td>
<td>Heliconia inflorescence</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Perija National Park, Tukuko, Rio Manantial</td>
<td>yellow heliconia inflorescenses (spherical)</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>Perija National Park, Tukuko, Manantial trail</td>
<td>red heliconias</td>
</tr>
<tr>
<td><strong>Phytolomata</strong></td>
<td>Venezuela</td>
<td>El Tama National Park, Rio Negro @ bridge crossing</td>
<td>red heliconia inflorescenses</td>
</tr>
</tbody>
</table>

7. Tell me more about these results.
Current Stats:

• 125,000 specimens
• Original Field notes from c. 2500 events
• More than 3000 habitat photographs
<table>
<thead>
<tr>
<th>Phylum</th>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3</th>
<th>Region 4</th>
<th>Region 5</th>
<th>Region 6</th>
<th>Region 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>alternatus</td>
<td>36</td>
<td>16</td>
<td>17</td>
<td>2</td>
<td>19</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>bolivari</td>
<td>101</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>139</td>
<td>1</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>bordoni</td>
<td>160</td>
<td>19</td>
<td>29</td>
<td>13</td>
<td>13</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>phyllaene</td>
<td>949</td>
<td>2</td>
<td>29</td>
<td>139</td>
<td>13</td>
<td>29</td>
<td>2</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>surinamensis</td>
<td>325</td>
<td>1</td>
<td>2</td>
<td>139</td>
<td>13</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>VZ_sp_A</td>
<td>118</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>VZ_sp_B</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Dytiscidae</td>
<td>Neobidessus</td>
<td>VZ_sp_C</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Radicidus sp. A

- 80% Lentic (General)
- 20% Lentic (Riparian)
- Lotic
- Hygroscopic
- Passive Trapping

n=40
Acknowledgments

Sarah Schmits, University of Kansas
Andy Bentley, University of Kansas
Michael Giddens, SilverBiology

Students: Taro Eldredge, Crystal Maier, Frazier Graham, Clay McIntosh

Institutional Collaborations:
Smithsonian Institution (David Furth, Warren Steiner, Charyn Michelli)
Universidad Central de Venezuela (Jose Clavijo, Marco Gaiani, Luis Joly)
Universidad del Zulia, Venezuela (Jesus Camacho)
National Zoological Collection of Suriname (Paul Ouboter)
Santa Barbara Museum of Natural History (Michael Caterino)