



Science for Your Protection

Making Automatic Mosquito Monitoring Smarter: Counting and Identifying Mosquito Species Using the New BG-Counter

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Science for Your Protection

What is the BG-Counter?

How does it work?

Field Data

Future Goals



BG-COUNTER

The BG-Counter is a key component of an innovative and autonomous mosquito trap station:

- It differentiates mosquitoes from other insects and counts them
- It then wirelessly transmits the results to a cloud server
- Via the web application you can manage the mosquito traps and get new insights into daily activity patterns, adult density indices, population dynamics and effectiveness of your control activities



BG-COUNTER

BG-Counter station with BG-Sentinel 2 trap, CO₂ tank, battery, stand and rain shield. The station runs on solar power.



BG-Counter



Top View



(solar panel not displayed here)

KEY FEATURES



- Reports mosquito counts with 15 min time resolution remotely from anywhere in the world on a web page
- GPS location and easy management of multiple devices
- Lets you manage the trap remotely
- Saves CO₂ with programmable application schedule
- Provides local environmental data including temperature, relative humidity, and ambient light
- Runs indefinitely on solar power



ADVANTAGES



Chart of Captures : 2016-07-22

List

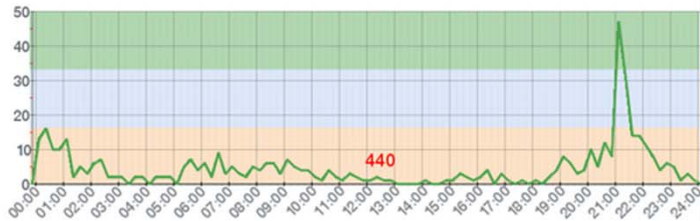


Chart of Captures : 2016-07-21

List

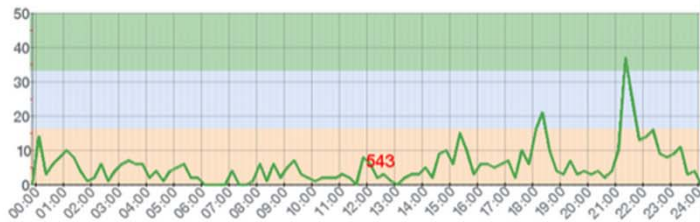
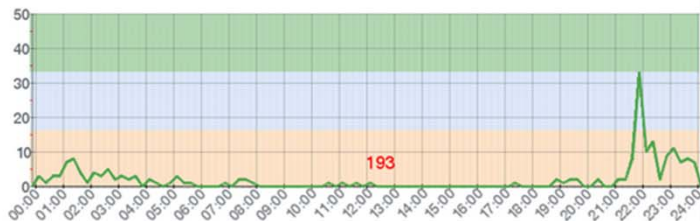


Chart of Captures : 2016-07-20

List



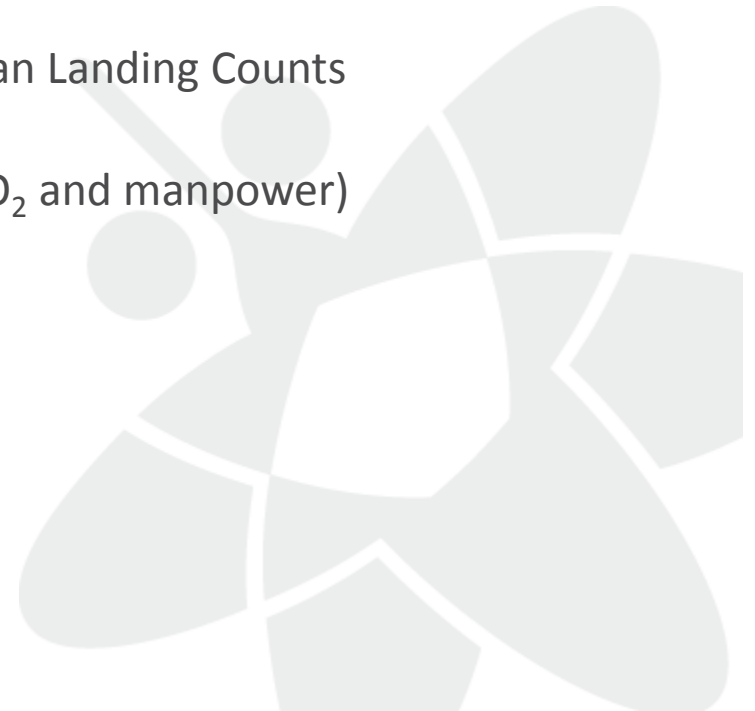
New insights into

- adult density
- daily activity patterns
- effectiveness of mosquito control activities

Reduces effort associated with manually setting and checking mosquito traps

Replaces Human Landing Counts

Saves costs (CO₂ and manpower)





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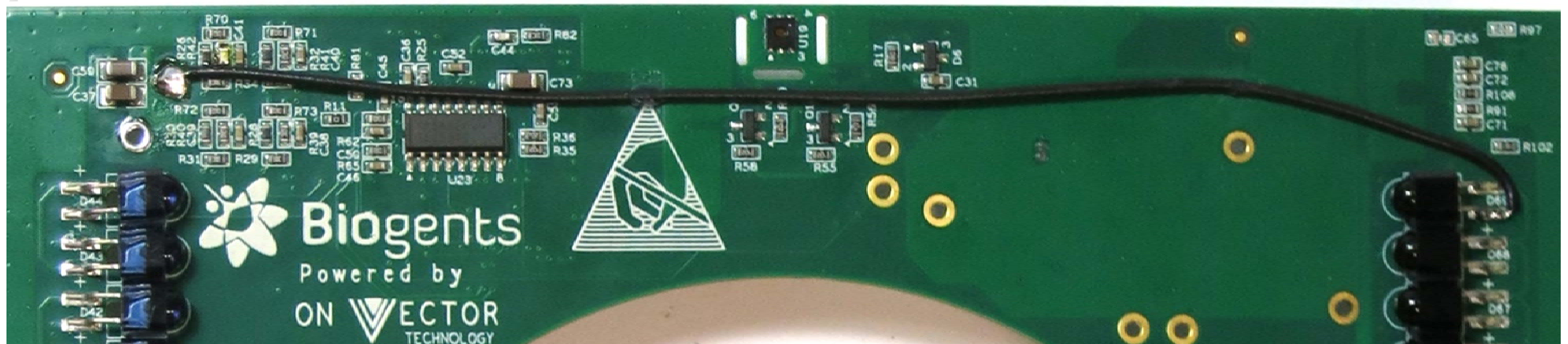


TECHNICAL DETAILS



The heart of the BG-Counter is a highly integrated printed circuit board

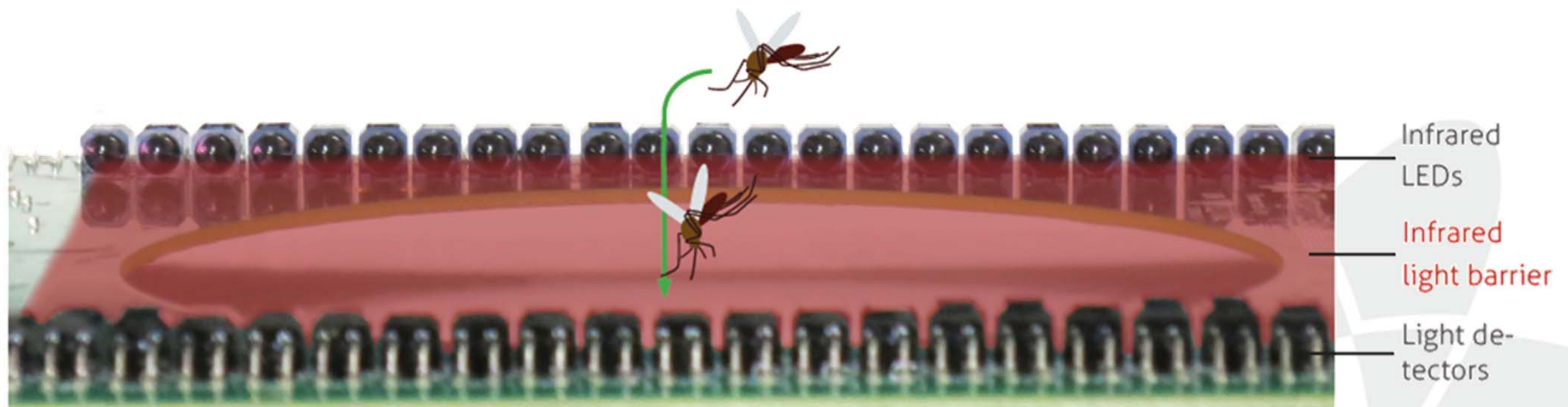
- An infrared insect sensor
- Two powerful microprocessors for control and communication
- SD card for onboard data storage,
- Fan and CO2 valve control
- Environmental sensors for temperature, relative humidity and ambient light
- A cellular module for communication with the web server, GPS location



MOSQUITO DETECTION

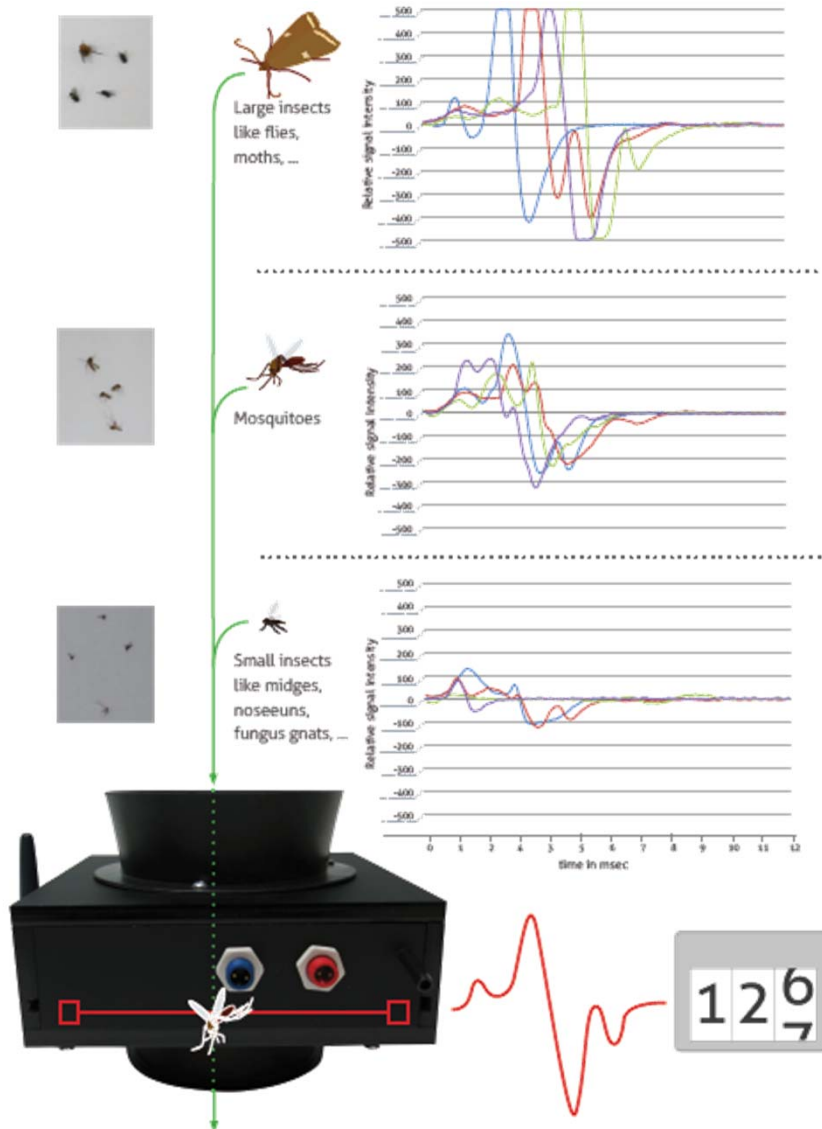
Patented insect sensor with:

- arrays of infrared LEDs and light detectors for reliable and sensitive detection
- analog and digital signal processing to differentiate mosquitoes from other objects entering



An insect is sucked through the BG-Counter and disrupts the infrared rays. This is detected by the light detectors.

MOSQUITO CLASSIFICATION



An insect sucked through the BG-Counter generates a “fingerprint” signal

This signal depends on size, shape, and wingbeat frequency of the insect.

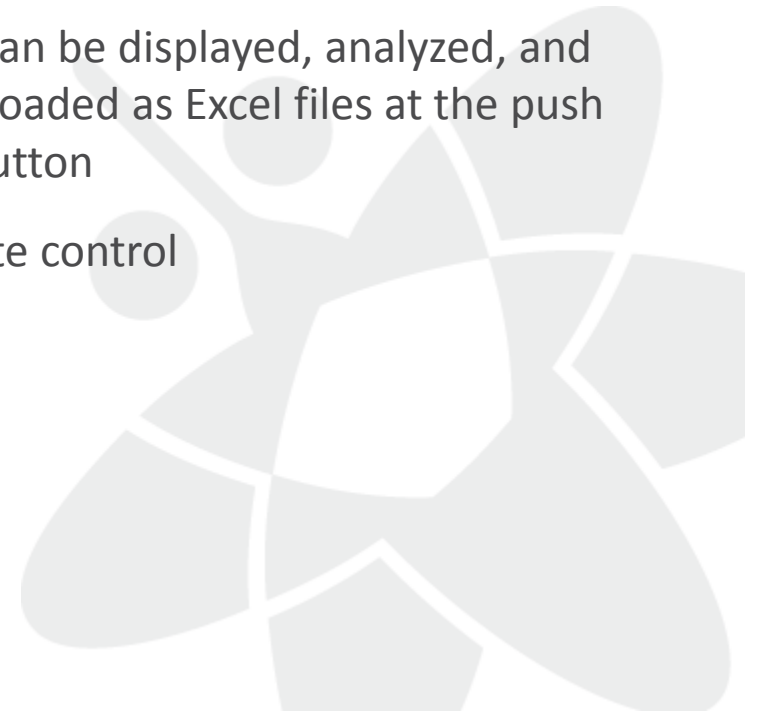
Mosquitoes are differentiated from the signals generated by larger or smaller insects.

The maximum counting frequency is about 5 mosquitoes per second = 18,000 mosquitoes per hour.

WEB SERVICE



- Data communication
- Cloud storage of mosquito counts, geospatial and environmental data
- Intuitive graphical user interface can be accessed from PCs as well as smartphones and tablets
- Data can be displayed, analyzed, and downloaded as Excel files at the push of a button
- Remote control



BG-COUNTER DASHBOARD

<http://live.bg-counter.com>



Biogents RemoteCounter martin.geier@biogents.com (Superadmin) [Power Icon]

- Dashboard
- Trap Management
- Profile
- Users
- Your Traps

ONVECTOR TECHNOLOGY
appmeistere[Icon]
REMOSIS

Trap Location

Trap Information

Name	861311009057026
IMEI	861311009057026
Location	13.751042, 100.539954 (Exact)
Last Connection	2017-12-07@11:00

Trap Schedule

Counts per 15 Minutes

Counter On: Fan On: CO2 On: Trap data sent: [Legend]



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FIELD VALIDATION



Field testing in the Florida Keys have shown mosquito counts with an accuracy of 90% when working with CO₂ as an attractant. Program released CO₂ in half hour intervals.

Date Set	Date Collected	Counted By	Total	% Accuracy
14/10/2015	15/10/2015	Human	120	100%
		BG-Counter	120	
21/10/2015	22/10/2015	Human	139	99.3%
		BG-Counter	140	
23/10/2015	24/10/2015	Human	171	98.8%
		BG-Counter	173	
27/10/2015	28/10/2015	Human	169	95.3%
		BG-Counter	161	
14/12/2015	15/12/2015	Human	183	77.2%
		BG-Counter	237	
15/12/2015	16/12/2015	Human	164	79.2%
		BG-Counter	207	
05/01/2016	06/01/2016	Human	5	35.7%*
		BG-Counter	14	
09/01/2016	10/01/2016	Human	38	82.6%
		BG-Counter	46	
13/01/2016	14/01/2016	Human	11	100%
		BG-Counter	11	

* = heavy rain during sampling

FIELD VALIDATION



Additional field testing in Suffolk, VA also showed mosquito counts with an accuracy of 90% when working with CO₂ as an attractant. Here, CO₂ was released continuously.

Date Set	Date Collected	Counted By	Mosquitoes	% Accuracy
15/10/2015	16/10/2015	Human	136	95.59%
		BG-Counter	130	
20/10/2015	21/10/2015	Human	67	83.75%
		BG-Counter	80	
21/10/2015	22/10/2015	Human	197	94.42%
		BG-Counter	186	
22/10/2015	23/10/2015	Human	259	85.71%
		BG-Counter	222	
26/10/2015	27/10/2015	Human	55	83.64%
		BG-Counter	46	
27/10/2015	28/10/2015	Human	450	90.00%
		BG-Counter	405	
28/10/2015	29/10/2015	Human	404	94.80%
		BG-Counter	383	
29/10/2015	30/10/2015	Human	695	90.36%
		BG-Counter	628	
03/11/2015	04/11/2015	Human	238	86.97%
		BG-Counter	207	
04/11/2015	05/11/2015	Human	206	87.86%
		BG-Counter	181	
05/11/2015	06/11/2015	Human	199	90.95%
		BG-Counter	181	



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„Remote Mosquito Situation and Identification System



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Project Goal:
„Make it species specific“

The development of the BG-Counter was partly supported by the EU's 7th Framework Programme (grant 306105,), the continuation of the development is being supported by the EU's Horizon 2020 programme (grant 691131)

REMOSIS PROJECT



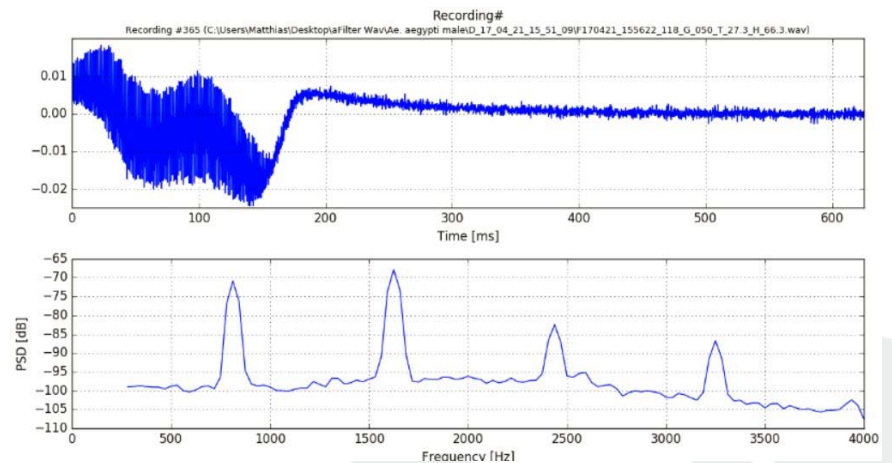
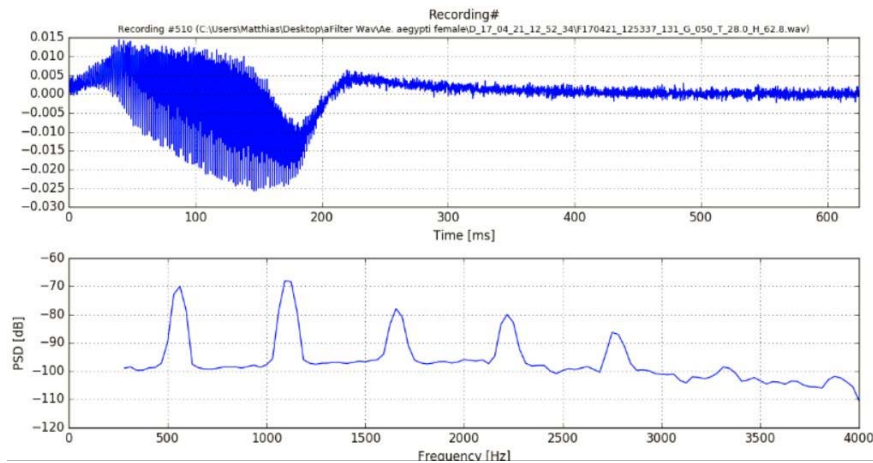
Measuring wing beat frequency
of individual mosquito



Differentiation between
males ♂ and females ♀

♀ *Aedes aegypti*

♂ *Aedes aegypti*



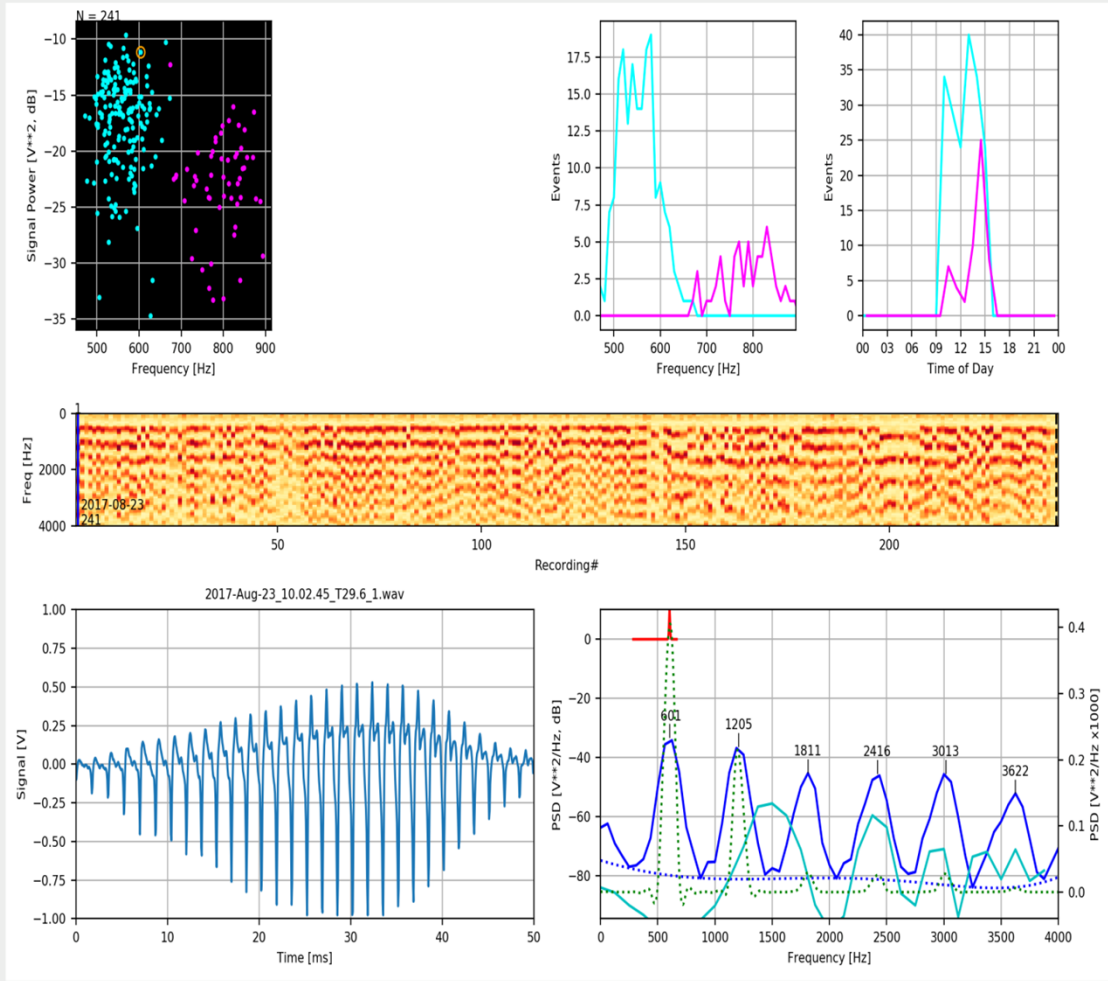
Typical optoacoustic recordings of female and male *Aedes aegypti* wing-beat events recorded as they crossed the optical sensor and Power Spectral Density (PSD)

REMOSIS PROJECT: Lab Data with *Ae. aegypti*



File Clean Analyze View

Directory: /Users/Michael/Dropbox/onVector/Projects/Remosis/Optics/REMOSIS PCB Design/Aedes Aegypti Data/Eye/2017-08-23



Collection	
All (n=241) [Hz]	613 (576) ± 108
Duration [ms]	43 ± 6
Gaussian Mixture; N =	2
Score (1 = best)	0.483
Cluster 1 (n=185) [Hz]	559 (555) ± 40
Cluster 2 (n=56) [Hz]	783 (798) ± 54

# 1	
f1 (HA) [Hz]	603
f1 (HPS) [Hz]	603
Duration [ms]	46
First PSD Peak [Hz]	601
PSD Peak Spacing [Hz]	604
Harmonics	5/5
Harmonic Match	A (1/6)
s/n	2669.4
Signal Power (x1000)	76.877
Baseline Power (x1000)	0.029
Low Frequency Power (x1000)	0.073
Temperature [°C]	29.6

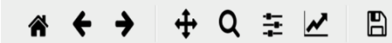
MANUAL COUNTS

Total Bag count
n=244

Ae. aegypti ♀
n=187

Ae. aegypti ♂
n=57

Accuracy (male
count) = 98%



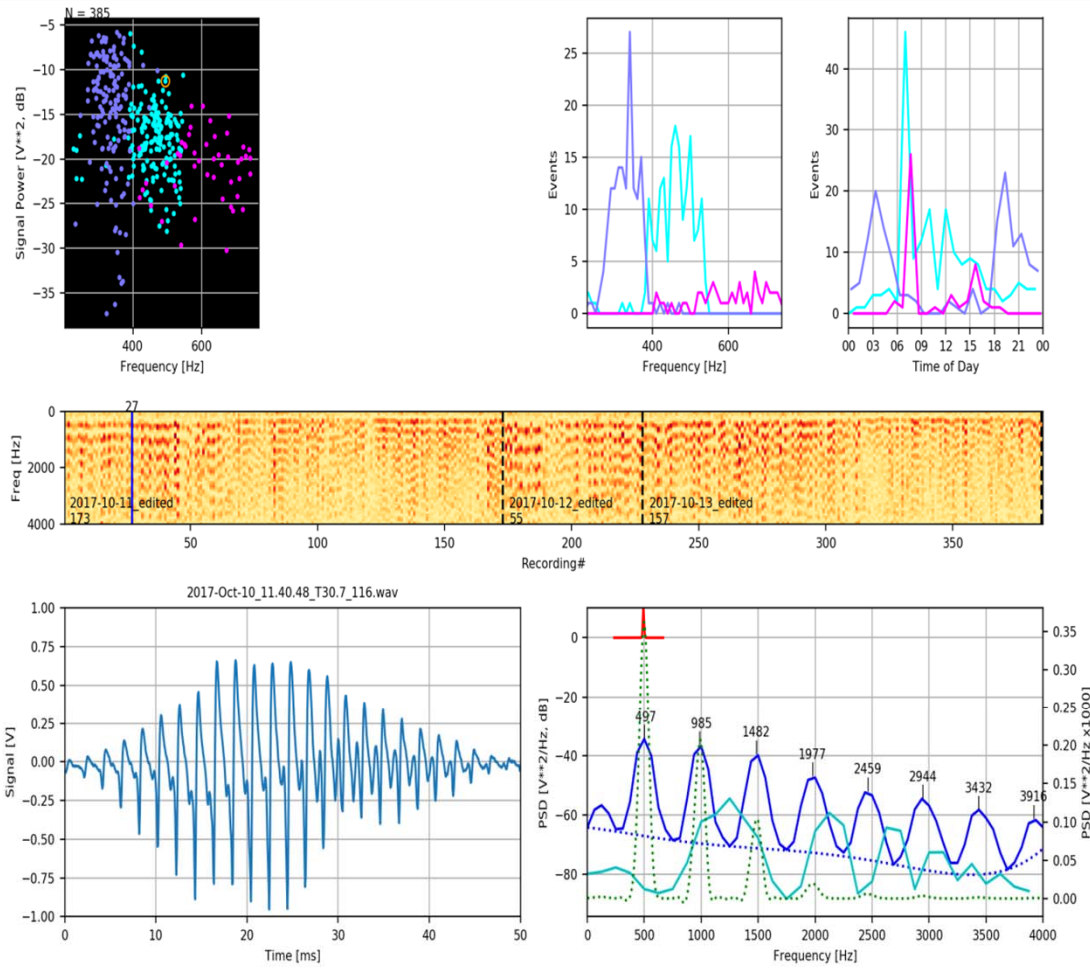
Ready

REMOSIS PROJECT: Field Data in Suffolk, USA



File Clean Analyze View

Directory: /Users/Michael/Dropbox/onVector/Projects/Remosis/Data/Suffolk/2017-10-11_to_13



Collection	
All (n=385) [Hz]	427 (424) ± 106
Duration [ms]	46 ± 0
Gaussian Mixture; N =	3
Score (1 = best)	0.198
Cluster 1 (n=180) [Hz]	460 (466) ± 57
Cluster 2 (n=157) [Hz]	335 (335) ± 36
Cluster 3 (n=48) [Hz]	609 (620) ± 92
# 27	
f1 (HA) [Hz]	494
f1 (HPS) [Hz]	492
Duration [ms]	46
First PSD Peak [Hz]	497
PSD Peak Spacing [Hz]	495
Harmonics	5/5
Harmonic Match	A (1/6)
s/n	282.6
Signal Power (x1000)	74.465
Baseline Power (x1000)	0.264
Low Frequency Power (x1000)	0.317
Temperature [°C]	30.7

MANUAL COUNTS

Total Bag count
n=433

Ae. Albopictus ♀
n=195

Culiseta melanura
n=177

Ae. Albopictus ♂
n=67

Accuracy (male
count) : 72%



x=15 y=44.3708

Ready

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