

**Everyone seems to have
a better mosquito trap:
Making sense of mosquito trapping**

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Thank you



Mark Gregory Robson

Distinguished Service
Professor



Isik Unlu

Superintendent Mercer
County Mosquito Control

Objectives

- Introduction
- History
- Review
- Goals
- Better traps
- Local needs



From the beginning

- Adequate sampling
- History local work
- Nullified
- “Failure” explained
- Problem found
- Weaknesses



TJ Headlee (on rt) on Atlantic County meadow ca 1916

Intelligent sampling

Many human collectors

We call this surveillance

- Webster's
 - To watch over
 - Close watch kept over someone
 - Constant observation of a place or process
 - Supervision or inspection



Mosquito surveillance

Surveillance



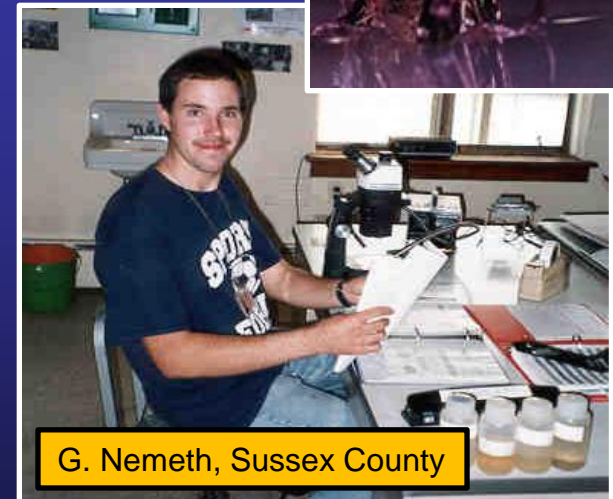
Gravid trap Warren County NJ



G. Cardini Hudson County NJ

Monitoring

- Time consuming
 - Collect, rear, ID
- Information important
- Provides foundation
- Justifies intervention
- Historic record
- Yr to yr comparisons



Philosophy

- Measure populations
- Prioritize intervention
- Measure effectiveness of abatement
- Target pest and/or habitat specifically in financially efficient & environmentally friendly manner



Mosquito surveillance program drives process

Program components

- Rainfall & tides
- Survey & mapping
- Larval sampling
- **Adult collections**
 - w/ traps
- Identification
- Virus testing
- Complaints



W. Crans Rutgers & V. DeSerio Bergen County NJ

Finding larval habitat

- Surveys
- Inspectors
 - On foot, bicycles, horses
- Discover habitats
 - Temporarily treat
 - Eliminate



Adult collections used to evaluate efforts

Adult mosquitoes find you

- Nightly collections
- Mosquito fighters
- Drawback
- Human factor
 - Honesty
 - Attractiveness
 - Skill
 - Variation
- 1927 remove human factor

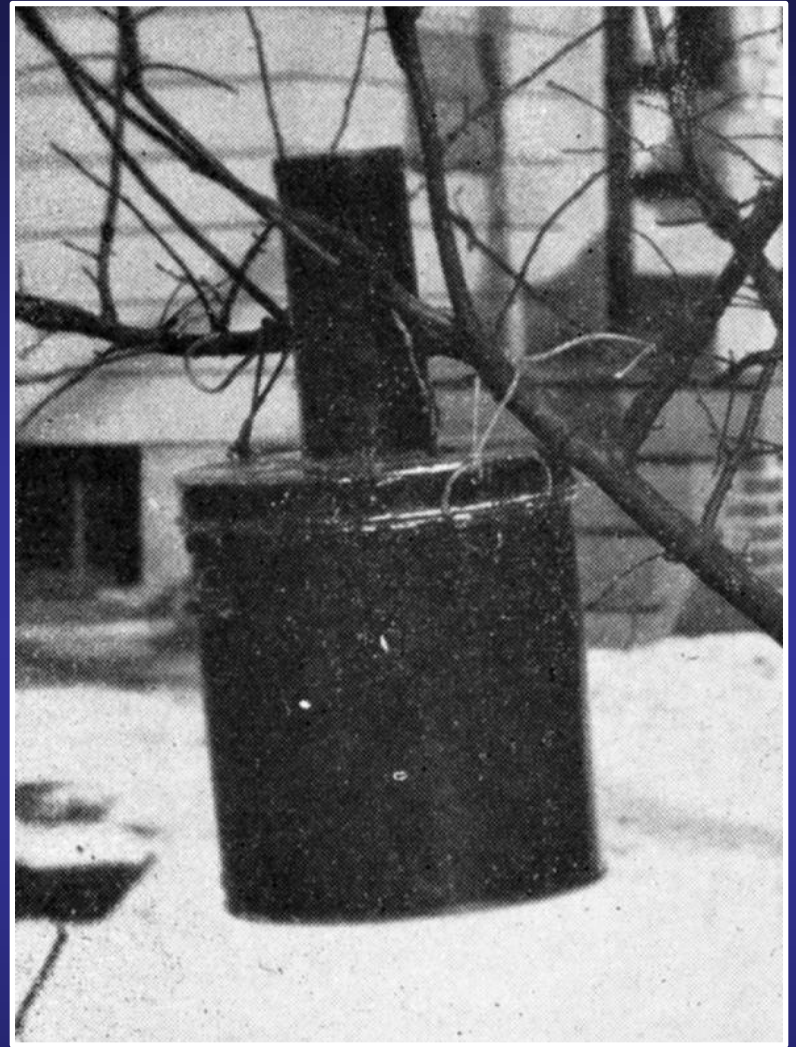


Living conditions Newark ca 1903

Mechanical means sought to collect adult mosquitoes

Sugar can trap

- Tin sugar can
- Inverted screen funnel
- Light
- Portable
- Battery
- 4' off ground
- Killing agent



Trap hung at Headlee's house 1927

Cost \$1.5 to build, battery was 30 cents more & ran for 72 hrs

TABLE 1—Record of Trap Nests

Man against machine

Date	Number of Traps	<i>Cantator</i>	<i>Sollicitans</i>	<i>Sylvestrus</i>	<i>Canadensis</i>	<i>Stimulans</i>	<i>Pipiens</i>	<i>Triseriatus</i>	Total	Average per Trap	Greatest Number	Smallest Number	Maximum	Minimum	Remarks
9/15-9/20	8	..	..	9	..	..	..	..	28	3.5	7	0	85	65	Lighted (electric)
9/21-9/22	10	..	..	4	..	4	5	1	14	1.4	5	0	63	61	Lighted (electric)
9/22-9/23	5	..	..	2	..	4	3	..	9	1.8	4	0	66	55	With lights
9/22-9/23	5	..	..	..	..	..	..	..	9	1.8	4	0	66	55	Without lights
9/26-9/27	6	..	..	2	1	2	1	..	6	1.0	3	0	59	57	Electric lights
9/28-9/29	4	..	..	..	..	..	..	..	0	..	..	..	..	..	Kerosene lights
9/28-9/29	4	..	..	3	..	1	3	..	7	1.7+	3	0	61	58	lighted (electric)
9/28-9/29	4	..	..	3	..	1	3	..	7	1.7+	3	0	61	58	Blinded—
9/29-9/30	2	..	..	..	..	..	..	..	0	..	..	..	82	62	lighted (electric)
9/29-9/30	2	..	..	3	..	..	1	..	4	0.6	1	0	82	62	bottom-open trap
9/29-9/30	2	..	..	2	..	1	1	..	4	2.0	2	2	82	62	lighted (electric)
9/29-9/30	2	..	..	2	..	1	1	..	4	2.0	2	2	82	62	bottom-open trap
9/30-9/31	2	..	..	4	1	..	1	..	6	3.0	4	2	74	69	Unlighted
9/30-9/31	2	..	..	4	1	..	1	..	6	3.0	4	2	74	69	Lighted (electric)
9/30-9/31	2	..	..	4	1	..	1	..	6	3.0	4	2	74	69	Lighted (electric)
9/30-9/31	2	..	..	4	1	..	1	..	6	3.0	4	2	74	69	bottom-open trap
10/1-10/3	7	..	..	4	..	1	1	1	7	1.0	2	0	89	65	Unlighted
10/1-10/3	2	..	..	5	1	12	2	..	20	10.0	13	7	89	65	Lighted (electric)
10/1-10/3	2	..	..	5	1	12	2	..	20	10.0	13	7	89	65	Lighted (electric)
9/22 7.15 to 7.45 P. M.	Two collector traps with two tubes each	..	..	..	6	2	6	1	16	8.0 per collector	..	..	66	55	bottom-open trap The object here is to check human collector against trap

• No light, no catch

• Large opening on bottom, better

• Dusk to dawn, similar to human collector

• Abundant mosquitoes, composition good

• Further testing indicated

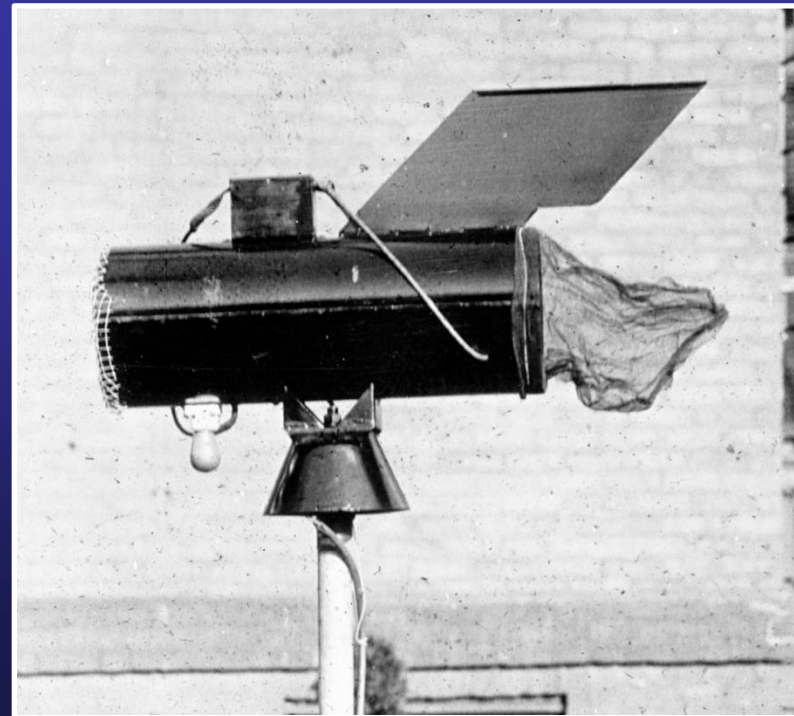
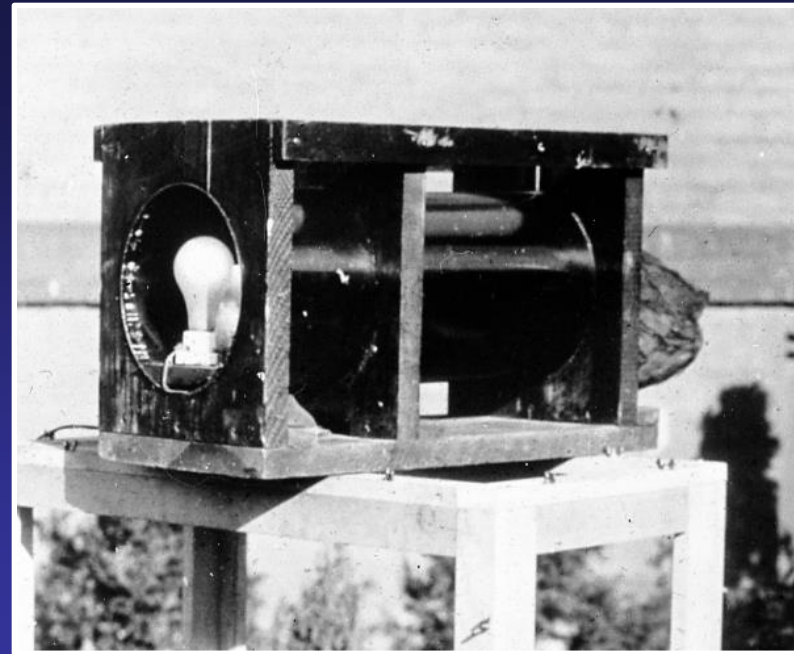
• Mosquitoes scarce, trap failed

• Practical experience indicated it did not meet the need!

Note: All traps, unless specially designated as "bottom-open traps," are cylindrical sugar cans about 12 inches by 10 inches with 6 inlet ports. Traps designated as "bottom-open traps" are likewise cylindrical sugar cans of same dimension, but with entire bottom forming an inlet port.

3 years later

- Electric
- Light (different colors)
- Fan
- Net
- Outperformed human collector 2:1
- Representative
- White light better
- Flight activity & temp



1931-1932 statewide system

w/ type C trap

- 35 traps running
- \$25/trap (high)
- Bulky design
 - Transportation, shipping & servicing
- Cyanide jar flooded
- Electric parts corroded
- Vibration & noise
- Light failure



Improvement needed

Model 50 trap

- All new traps 1933 (41)
- Vertical trap (w/ light above)
- Funnel 16x16-mesh copper wire screen
- Half-pint cyanide jar
- 3 legs
- Conical roof (white, 360°)
- Rubber light mount
- Cost less (\$17.50 w/ timer)



**This one was a
keeper!**

Note: Human collectors still working

Adult surveillance methodology

- Complaints
- Landing counts
- Light trap
- CO₂
- Oviposition/ gravid
- Animal-baited
- Resting boxes
- Visual
- Propane driven
- Etc...



A. Angelus, Salem County NJ

NJLT
Hausherr's Machine Works
Toms River, NJ

Attractants & trapping

- Built in bias
- Species differences
 - Some traps are better
 - Species & regional differences (same traps)
- Trap placement
- Incorporate several methods
- *Aedes japonicus* example
 - Initially nothing worked well



New Jersey light traps

- Standard
- Light is attractant
- Established sites
- Run May – October
 - Dusk to dawn
 - Timers and photo cells
- Collect d, 3 or 1 x wk
- Electric (\$\$\$)
- Records date to 1930's



Variety of insects, male's
Important to calibrate all traps

Commonly found in NJLT

- *Aedes vexans, cinereus, canadensis, atropalpus, cantator, taeniorhynchus, grossbecki, stimulans, excrucians, fitchii, atlanticus, trivittatus, abserratus, sticticus, triseriatus, sollicitans*
- *Anopheles punctipennis, bradleyi, crucians, walkeri, quadrimaculatus*
- *Coquillettidia perturbans*
- *Culiseta morsitans, inornata, melanura*
- *Culex territans, pipiens, restuans, salinarius*
- *Psorophora howardii, ciliata, ferox, columbiae*
- *Uranotaenia sapphirina*

- “Things” attracted to light
- Underrepresented sp.
 - *Aedes trivittatus*
 - *Ae. sticticus*
 - *Ae. fitchii*
 - *Ae. abserratus*
 - *Ae. aurifer*
 - *Ae. stimulans*
 - *Ae. aegypti*
 - *Ae. albopictus*
 - *Ae. japonicus*
 - Etc.

Trap bias



CO₂ baited traps

CDC/EVS/ABC/MMX...

- Light & CO₂
- Portable traps
- Placed as needed
- Easily elevate traps
- Nightly collections
- Host seeking



EVS Trap

CDC/EVS/ABC/MMX traps...

- Require CO₂
- Light optional
- Set early evening
- Picked up the next morning
- Fresh / living specimens



CDC Trap

CO₂ baited traps

- Good indicator
- Greater diversity
- Fill void
- Labor intensive



ABC Trap

Mosquito Magnet[®]

- Heat, CO₂ & H₂O
 - No light
- Don't need electric
- Counterflow tech
- Ad attractant
- Host seeking
 - Biting adults



**\$\$\$ but similar to NJLT
from labor – cost for gas**

**Propane combustion
Reduce nuisance?**

Attractants

- Added to all traps
- Improve collections
- Cost
- Shelf life



Home made



Animal baited trap

Ehrenberg pigeon trap

- Bird attractant
 - Ornithophilic species
- Set late
 - Check hourly/nightly
- Keep bird alive
- Knock down mosquitoes
- Preserve on ice
- Release pigeon
- Maintain flock





South Walton County Mosquito Control District

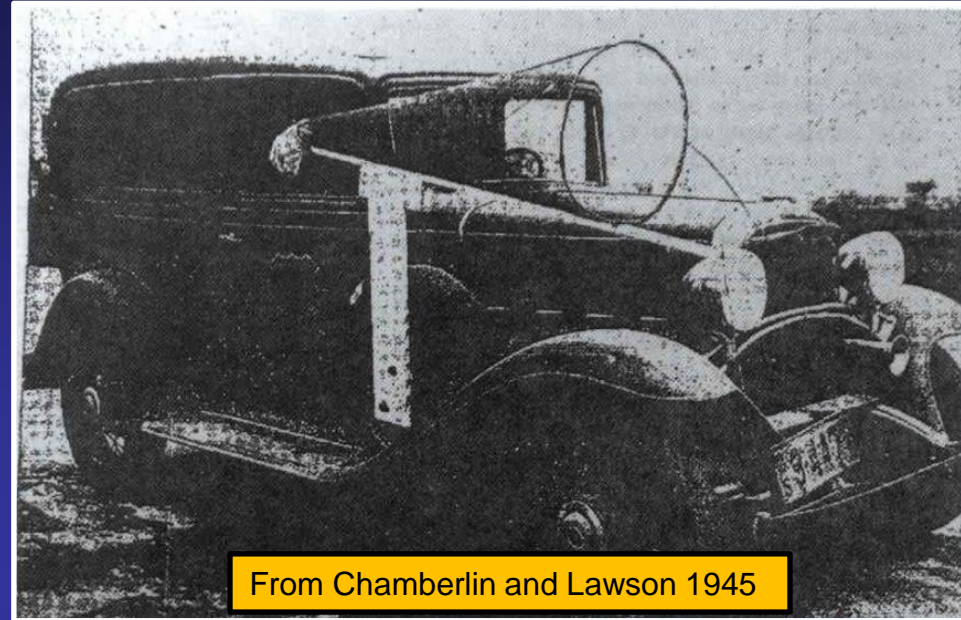
Truck Trap

- No attractant
- Sample taken over a distance
- Flight activity (behavior)
- Not selective w/ respect to sex or host seeking status

• Under utilized

But

- Open areas (roads) and sampling height bias



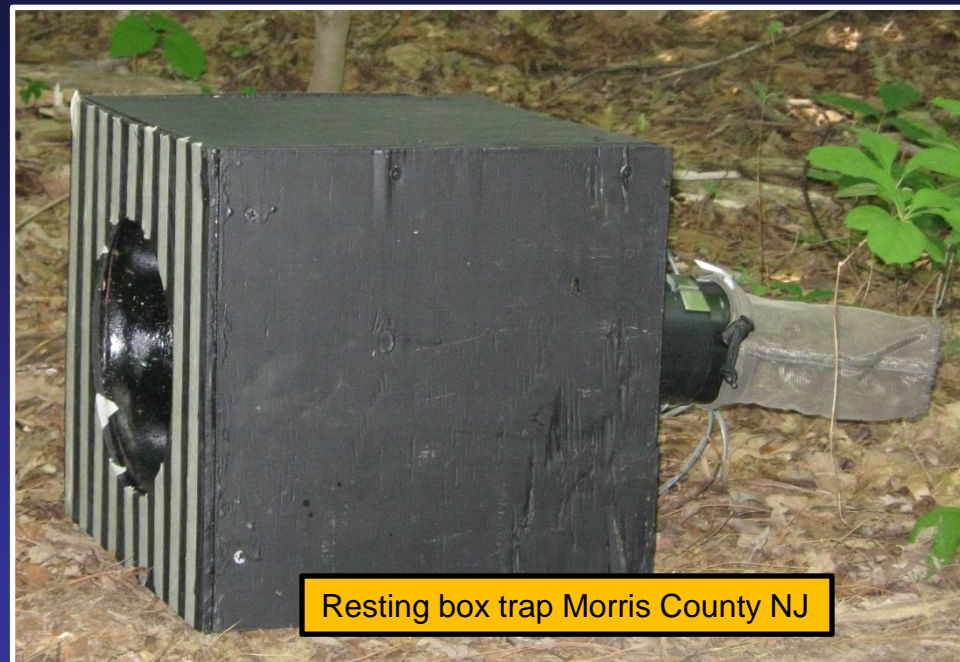
Resting box

- Cool dark place
- Live engorged mosquitoes
 - Arbovirus
- Very selective
- Passive
- Inexpensive
- Research tool



Representative data

- 7k – 14k specimens June / September
- Host preference studies
- Collected 16 NJ species
 - *Aedes cinereus*, *Ae. vexans*, *Ae. atropalpus*, *Ae. canadensis*, *Ae. thibaulti*, *Ae. triseriatus*, *Anopheles punctipennis*, *An. bradleyi*, *An. quadrimaculatus*, *Culiseta melanura*, *Culex erraticus*, *Cx. pipiens*, *Cx. restuans*, *Cx. salinarius*, *Cx. territans*, *Psorophora ferox*



Resting box trap Morris County NJ



CA resting box NWMVCD

Visual

Pasco County suction trap

- No light, dark object
- Fan draws insects in
- Are more mosquitoes better?
 - Population estimates
 - Low #s just as useful
 - Sampling pest species
 - Consistent effort
- Adjust intervention thresholds



Gravid traps

- Oviposition substrate
- Blood fed mosquitoes trying to lay eggs
- Fresh samples
- Arbovirus surveillance
- Exotic *Aedes* & male mosquitoes



Collects *Culex* sp. by the 1000s



Gravid Trap Modifications, A. Acquaviva, Monmouth County NJ



Ovitrap

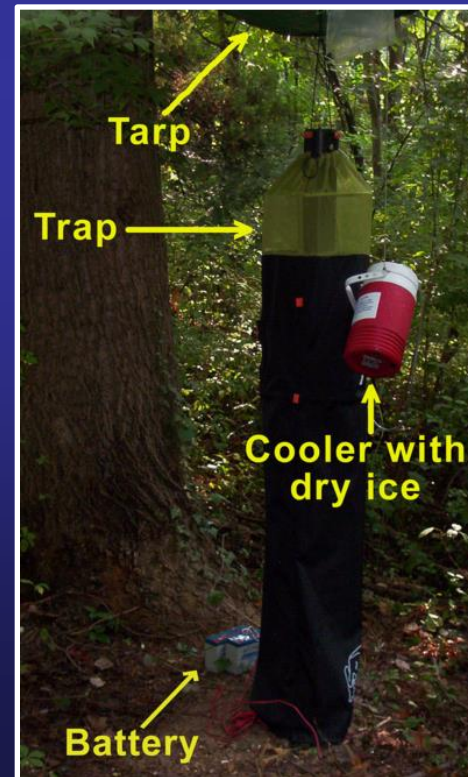
- Oviposition substrate
- Gravid mosquitoes
 - Containers
- Exotic *Aedes*
- Detect introduction
 - Ports (air & sea), railways, interstate stops
 - Boarder of range

Easier than searching for small containers



Exotic Aedes

- Contrasting colors
- Movement
- Commercial options
- Combined with lures



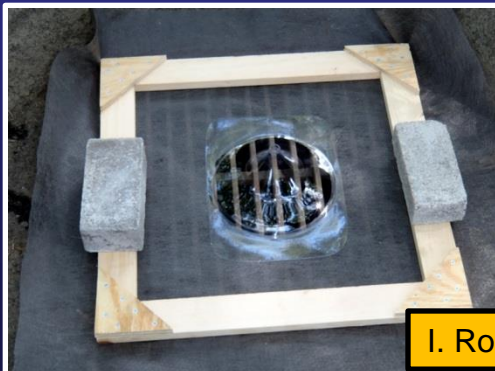
Adding another method to gain a better picture of the mosquito population

Emergence traps

- Bias is trap placement
- Check habitat or system
- Catch basins
- *Coquillettidia* & *Mansonia*



M. Romanowski, basin trap w/ 4 night sample Ocean County NJ



I. Rochlin, catch basin trap, Suffolk County NY

Choosing the right trap

- Depends on goals
- What are you trying to accomplish?
- Data use
- Monitor populations
- Arbovirus surveillance
- Control



York County PA, WNV surveillance trap set 2012

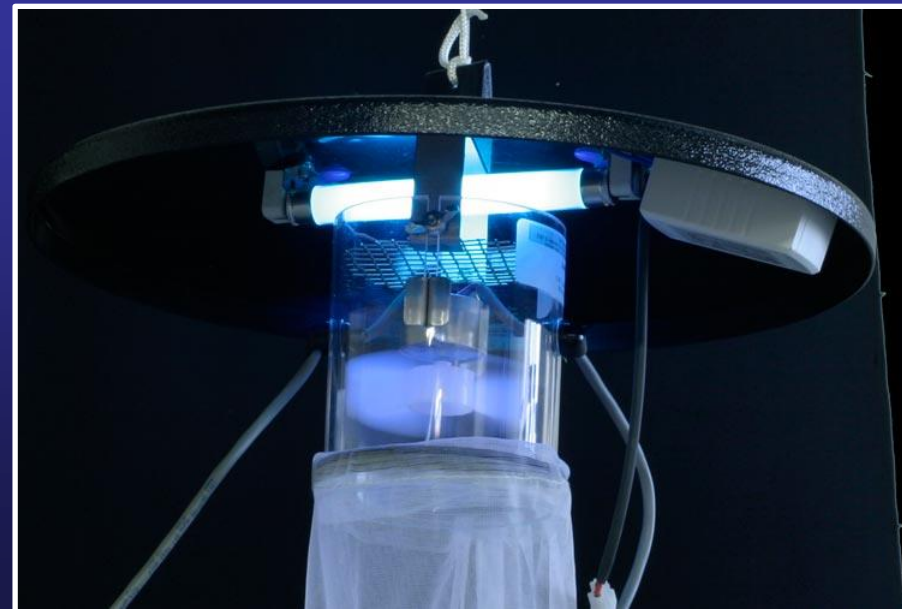
Monitoring populations

- Requires consistency over time
- Select reliable trap
- Simple is better
 - Reduce variables
 - Use same trap type throughout
 - Calibrate often
 - Understand trap bias
- Have backup supply



Change in effort

- Evaluating new system?
- Run both
 - Keep the old system going
 - Establish correlation
 - Thoroughly test
 - Preserve data integrity
- Problems take time



Landing rates

- Very selective
 - Host seeking
- Simple & quick
 - Count mosquitoes
 - Record time & temp
- Intervention need
- Willing participant
- Variability



Surveillance programs evolve

(to meet local needs)

- Local resources determine program support
- There is no one size fits all
- Research vs. operational level data
- Using data generated to adapt program is a continual process
- Sometimes there is a better trap
- An invasive species & WNV changed how we do things

Biology waits for no one

- What is it?
- Where are they?
- How many are there?
- Are they a problem?
- Where are they coming from?
- What are you going to do about it?



Fulltime professional staff

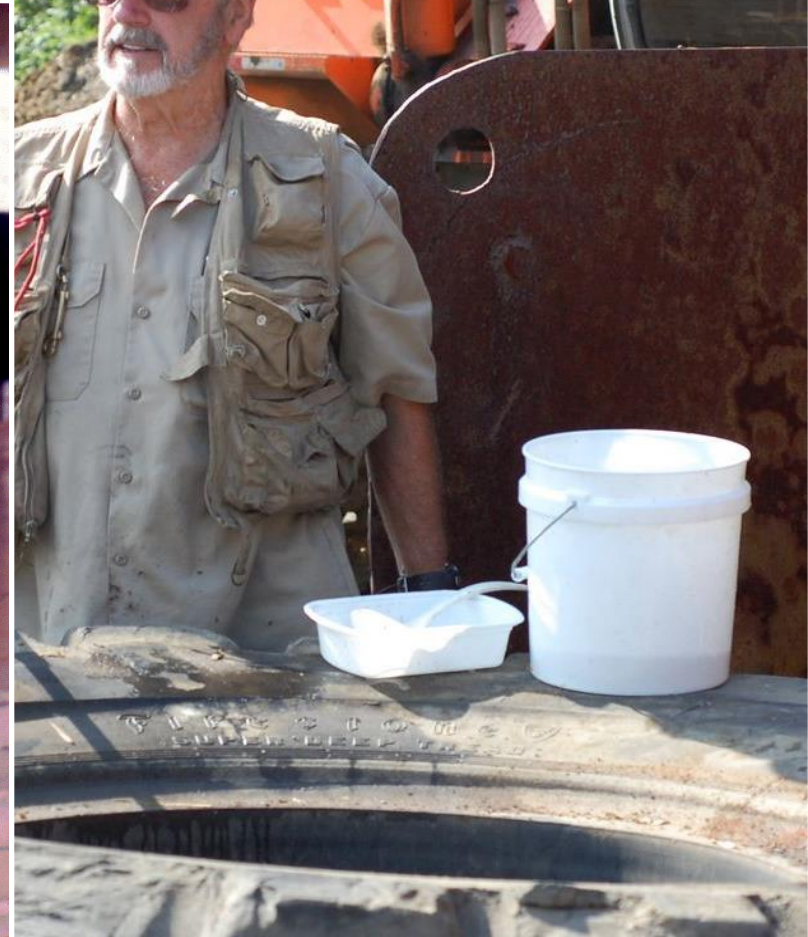
Inspectors, ID Specialists / Biologists / Pilots / Administrators

Act well your part, there all the honor lies

Alexander Pope

To forget one's purpose is the commonest form of stupidity

Friedrich Nietzsche



Questions & contact info

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