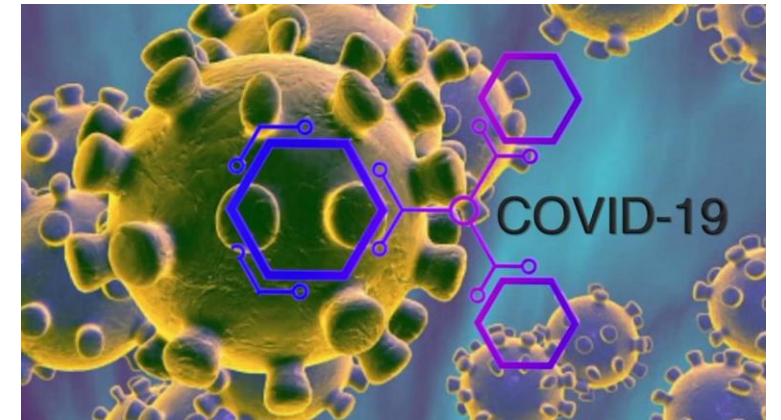


Overview and Background



2020 Significant Issues COVID-19

- Budget / Control Program
- Employee Changes



Budget and Control Program



- In January 2020, we planned to restore one third of services cut in 2017.
- By April 2020, we feared a levy deficit of 10-15% (usual planned deficit is 2%).
- Social distancing restricts us to one employee per vehicle – consequently we hired 16% fewer seasonal technicians than planned.
- We delayed hiring seasonal technicians two weeks to complete COVID-19 safety strategies.
- Provide as many services as possible while maximizing staff and citizen safety by implementing social distancing and all other COVID-19 safety requirements.
- Preserve our current cash reserves to insulate the District from negative economic impacts in 2020, 2021, and thereafter.



Budget and Control Program



	Jan 2020 Plan	85% 2020 Levy
Expected Levy	\$18,534,462	\$15,754,293
Planned Expenditure	\$17,190,778	\$15,962,936
Planned Service Restorations		

Increased Spring *Aedes*
(including P2)

Yes



Canceled

Increased cattail
(including P2)

Yes

Yes

Increased summer
floodwater (including P2)

Yes

Canceled

Budget and Control Program



In March 2020, we modified all operational procedures to satisfy CDC COVID-19 safety recommendations.

- Personal Hygiene
- Employee Social Distancing / Remote Work Capabilities
- Remote Training
- Facility Cleaning / Disinfection*
- MMCD Truck / Vehicle Disinfection*
- Sample and Equipment Disinfection*



* Many thanks to TAB members for advice

Budget and Control Program



	2016	2017	2018	2019	2020
Acres Larval Control	304,682	193,890	187,727	212,172	194,905
Acres Adult Control	82,967	42,012	38,479	22,325	6,450
Seasonal Technicians	238	234	229	229	184

- Decreased aerial pre-hatch treatments (especially costlier materials).
- Reserved Bti for aerial treatments to conserve limited N95 mask supplies.
- Conducted more limited check and treat work in ground sites but used pre-hatch (again mainly cheaper materials) instead of Bti when threshold larval abundances were detected.
- Adult control was lower, in part because adult mosquito abundance was lower overall and in part because fewer technicians were available.

Nighttime cold fogging was impacted the most.

Budget and Control Program



Successfully restrained expenditures below our target of \$15,933,030.

- Regular fulltime employee salaries were lower due to not filling a vacant full-time position and reduced overtime.
- Seasonal technician salaries were lower due to hiring fewer seasonal technicians and starting them two weeks later than usual and less overtime.
- Control material costs were lower because we preferentially used cheaper larvicides for large acre (mostly aerial) treatments.
- Helicopter costs were lower because of fewer aerial treatments due to dry weather.
- Capital expenses were lower because we delayed large cost purchases.

Budget and Control Program

Steps in late 2020 and early 2021



- Purchase some larger capital items (e.g., replacement vehicles, facilities maintenance items) before the end of 2020, items that otherwise would be purchased in 2021.
- Carry over more control materials so we need to buy less in 2021, especially if the economic situation in 2021 still is unfavorable.
- Review the economic situation by April 2021 to determine how to continue the District's longer-term plan to bring the levy and budget into parity.
- Based upon how we decide to proceed with the District's longer-term plan, determine if we have the funding to restore some services cut in 2017.

Employee Changes (2020)

District Operations Manager (DOM) – retired December

- Promoted a Regional Operations Manager (ROM)
- Promoted a Field Operations Supervisor (FOS) to fill ROM position left empty by promotion



- Plan to hire two Field Operations Supervisors by the end of March 2021, one to fill position left empty by promotion and one to fill the position of a longtime FOS who will retire in April 2021.
- Plan to hire same number of seasonal technicians as in 2020 because of COVID-19 restrictions (one person per vehicle)

Season Overview

Technical Advisory Board Meeting
February 11, 2021

Diann Crane
Entomologist

Outline

- Mosquito categories
- Environmental conditions
- Rainfall and broods
- Seasonal and geographic occurrence of major groups
- Priority zones

Mosquito Categories



Spring *Aedes*

One generation
Snow melt induces hatching
Live up to 3-4 months



Cattail Mosquito (*Cq. perturbans*)

One generation
Overwinter as larvae
Adults begin to emerge early June



Summer *Aedes*

Multiple generations
Rainfall induces hatching
2-3 week lifespan

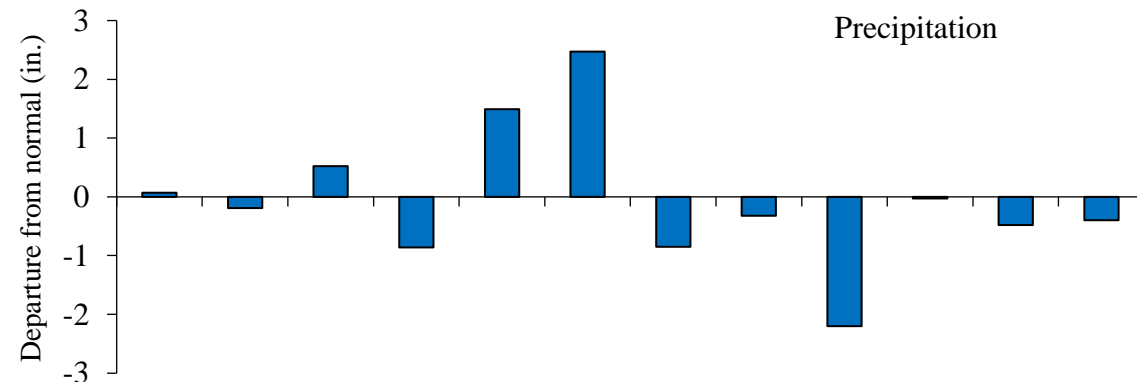
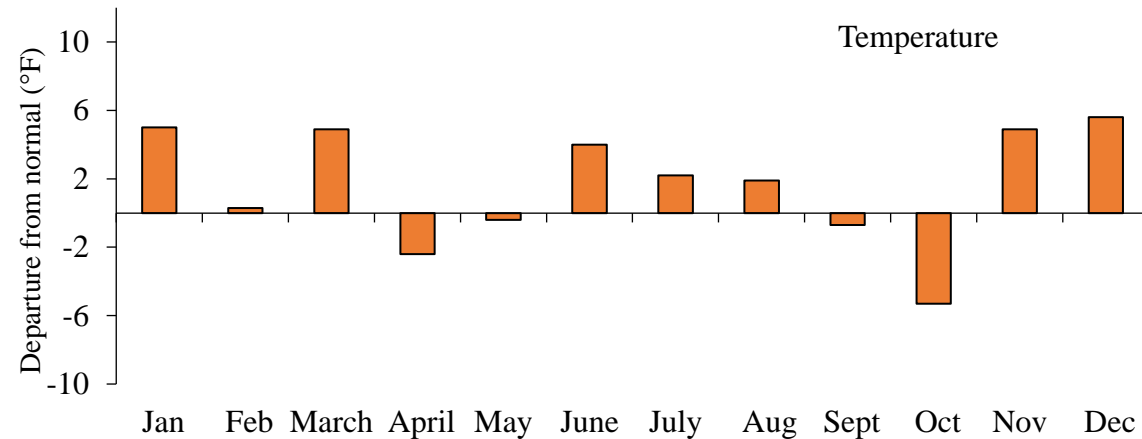


Culex Species

Multiple generations
Adults overwinter
Lay egg rafts in permanent habitats

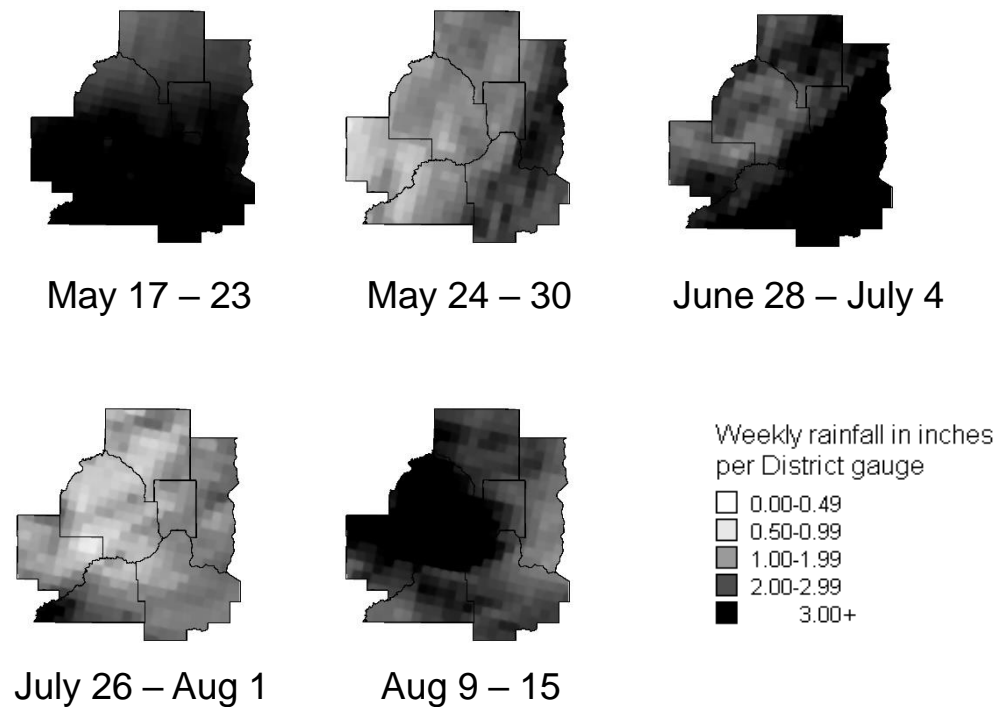
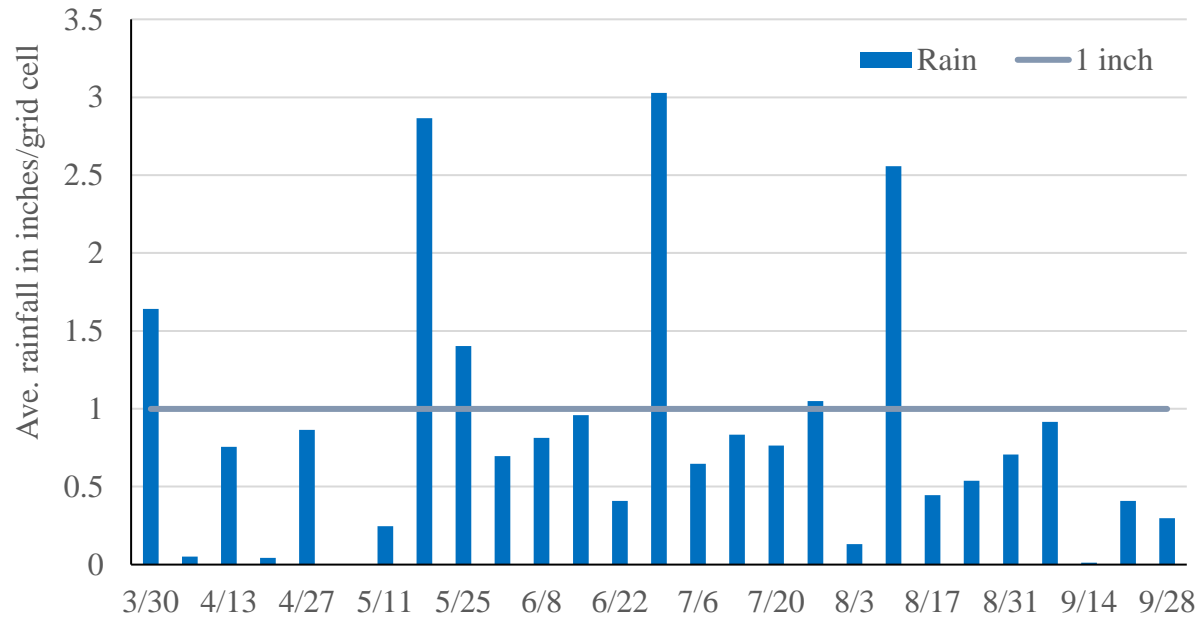
Environmental Conditions

- Winter/spring was generally warmer than normal; ice-out April 2
- Cooler temperatures prevailed in April and May
- June, July, August temps above normal
- 2020 is 13th warmest on record in MN, tied with 3 other years
- Snowfall was 11 inches below the norm
- An April snowstorm on Easter dumped 6.6 inches of snow in the Twin Cities
- May and June precipitation was above normal, but the rest of the year was below the norm



Rainfall and Broods

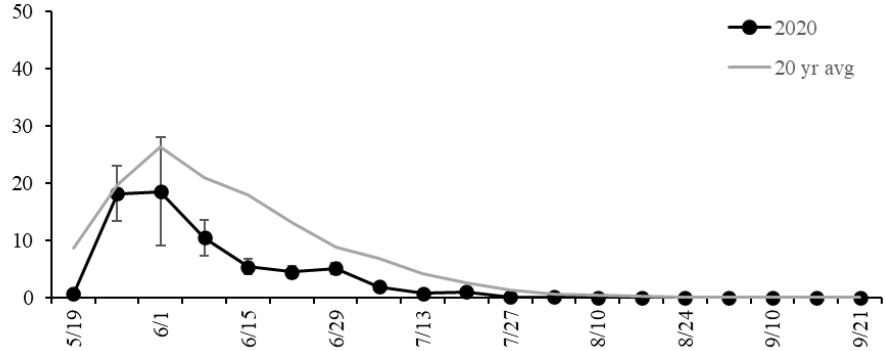
- Five very large rain events in mosquito season



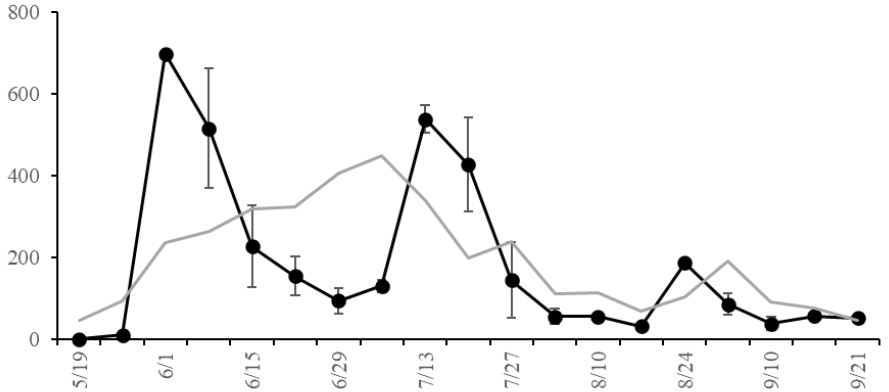
Seasonal Occurrence



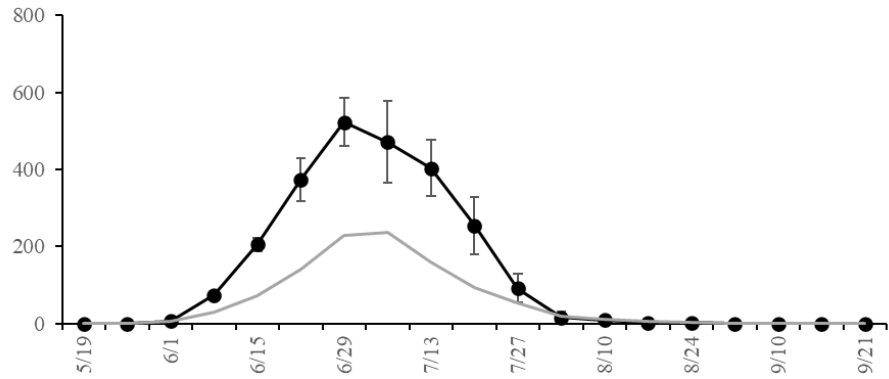
Avg. mosquitoes / CO₂ trap



Spring *Aedes*

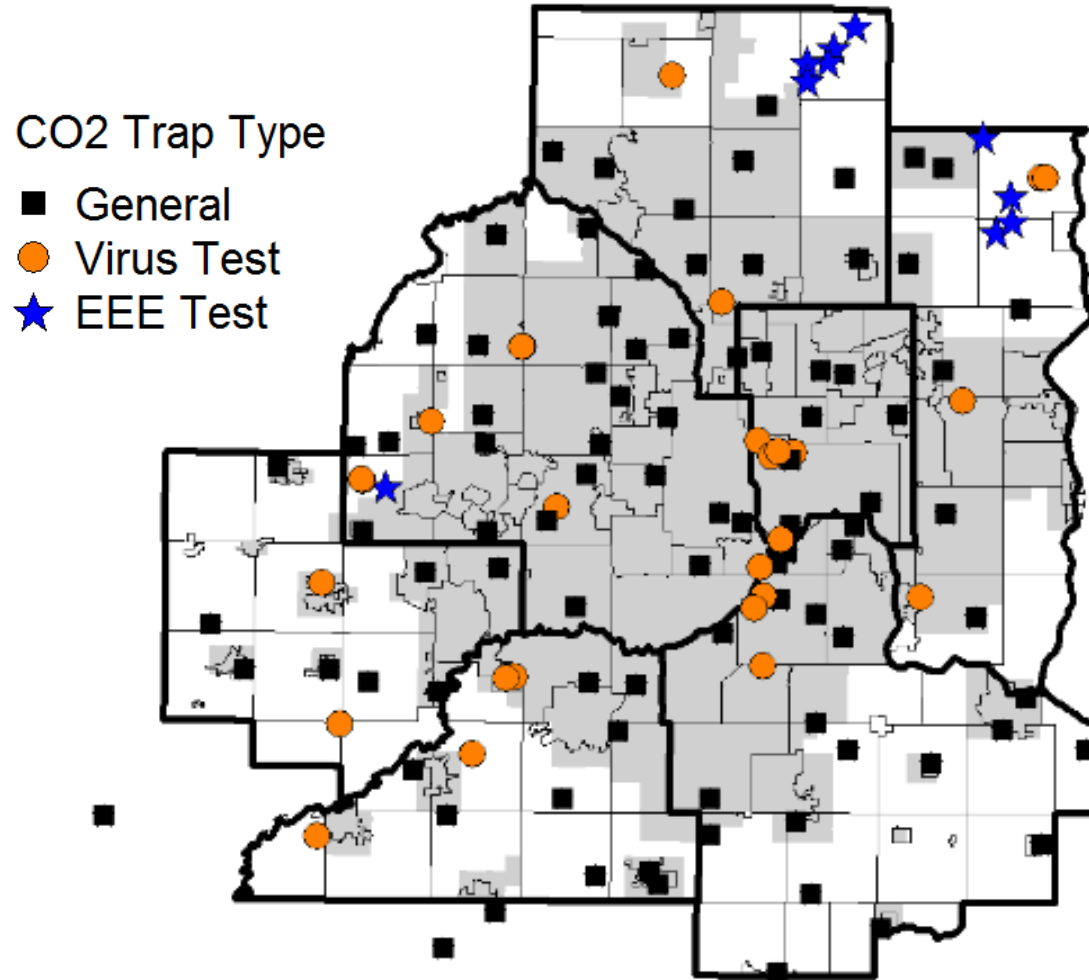


Summer *Aedes*

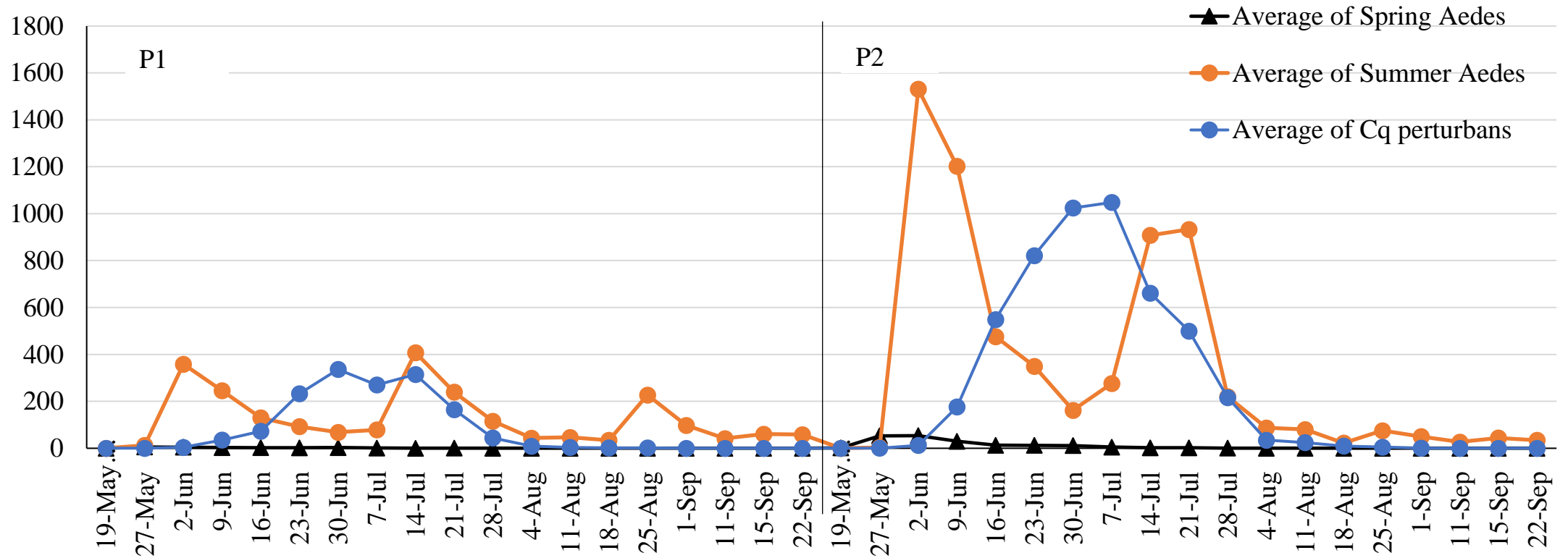


Cq. perturbans

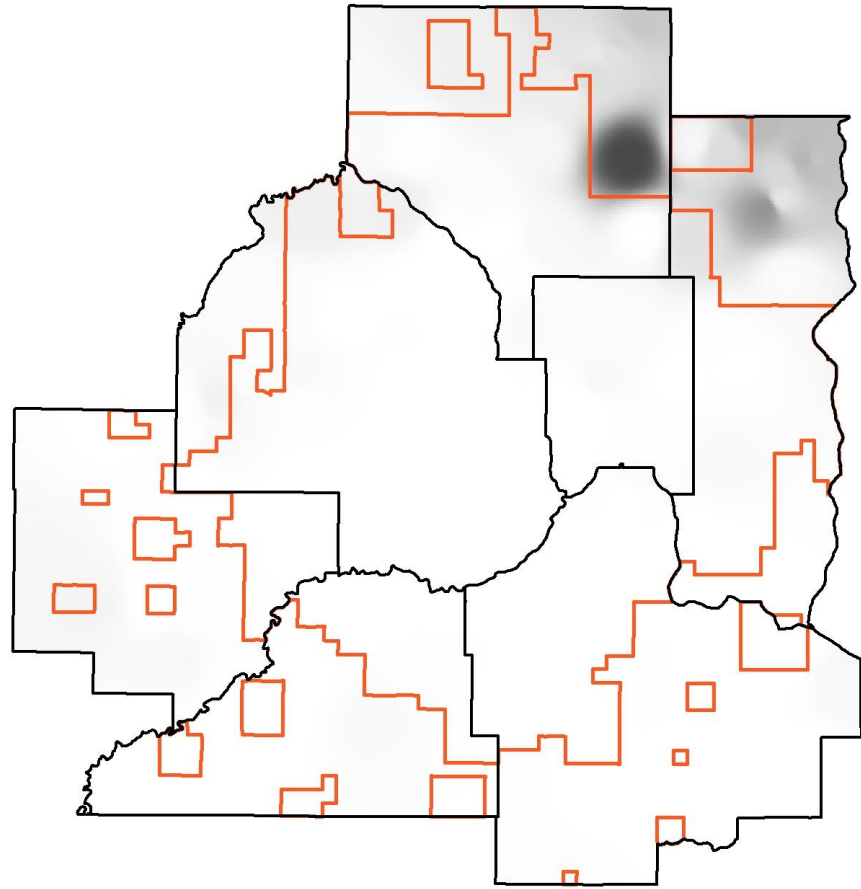
CO₂ Trap Sampling and Priority Zones



Avg Mosquitoes per CO₂ Trap by Priority Zone



Average Spring *Aedes* May 18 – Sept. 21



2020 Average Spring *Aedes*
per CO2 trap location

- 100+
- 75-99
- 50-74
- 25-49
- 0-24

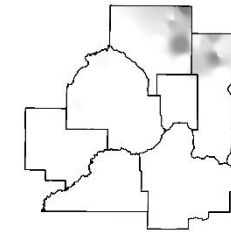
P1 Boundary



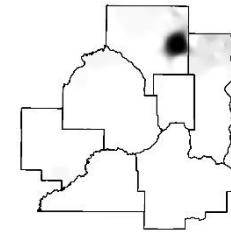
County Boundary



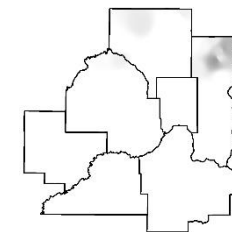
Average weekly counts



May 26



June 1

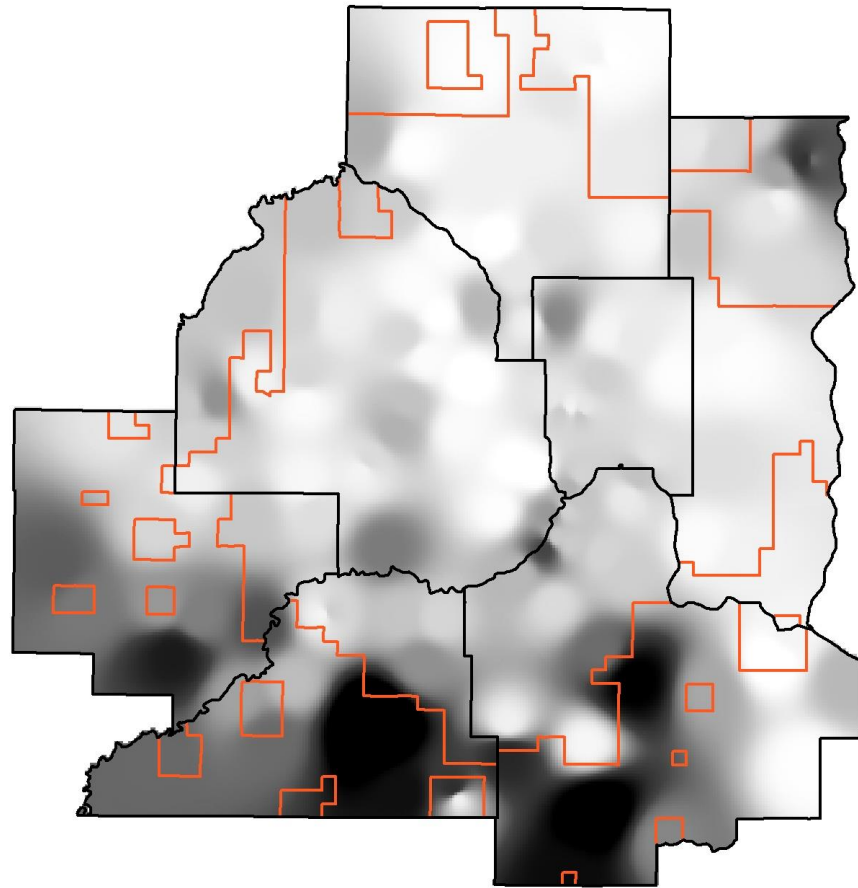


June 8

Number of spring *Aedes* mosquitoes
per CO2 trap collection

- 0-129
- 130-299
- 300-499
- 500-999
- 1,000+

Average Summer *Aedes* May 18 – Sept. 21



2020 Average Summer *Aedes*
per CO2 trap location

- 1,000+
- 500-999
- 300-499
- 130-299
- 0-129

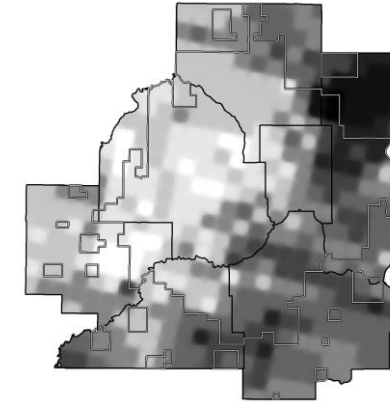
P1 Boundary



County Boundary



Rainfall: No. 1 inch rains and
cumulative rainfall for the season



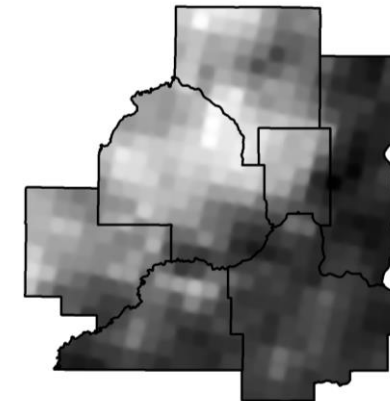
Count of 1+ inch rain events
May 10 - Sept 19

- 3
- 5
- 6
- 8
- 9
- 11

P1 Boundary



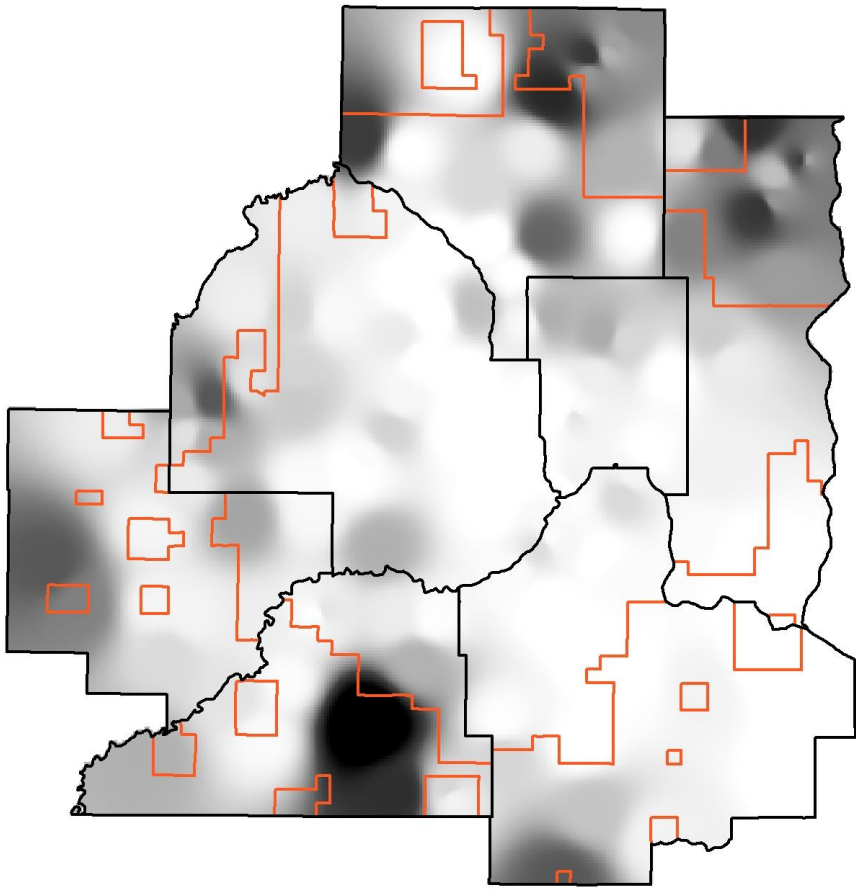
County Boundary



week21to39_rain by COL3

- 14
- 16.2
- 18.3
- 20.5
- 22.6
- 24.8

Average *Cq. perturbans* May 18 – Sept. 21



2020 Average *Cq. perturbans*
per CO2 trap location

- 1,000+
- 500-999
- 300-499
- 130-299
- 0-129

P1 Boundary



County Boundary



Summary

- Melting snow and summer rains = mosquitoes
- Different species collude to create your mosquito experience
- More abundance in P2 vs P1
- But still, mosquitoes are everywhere....

2020 MN State Fair



Mosquito-borne Disease 2020 Season

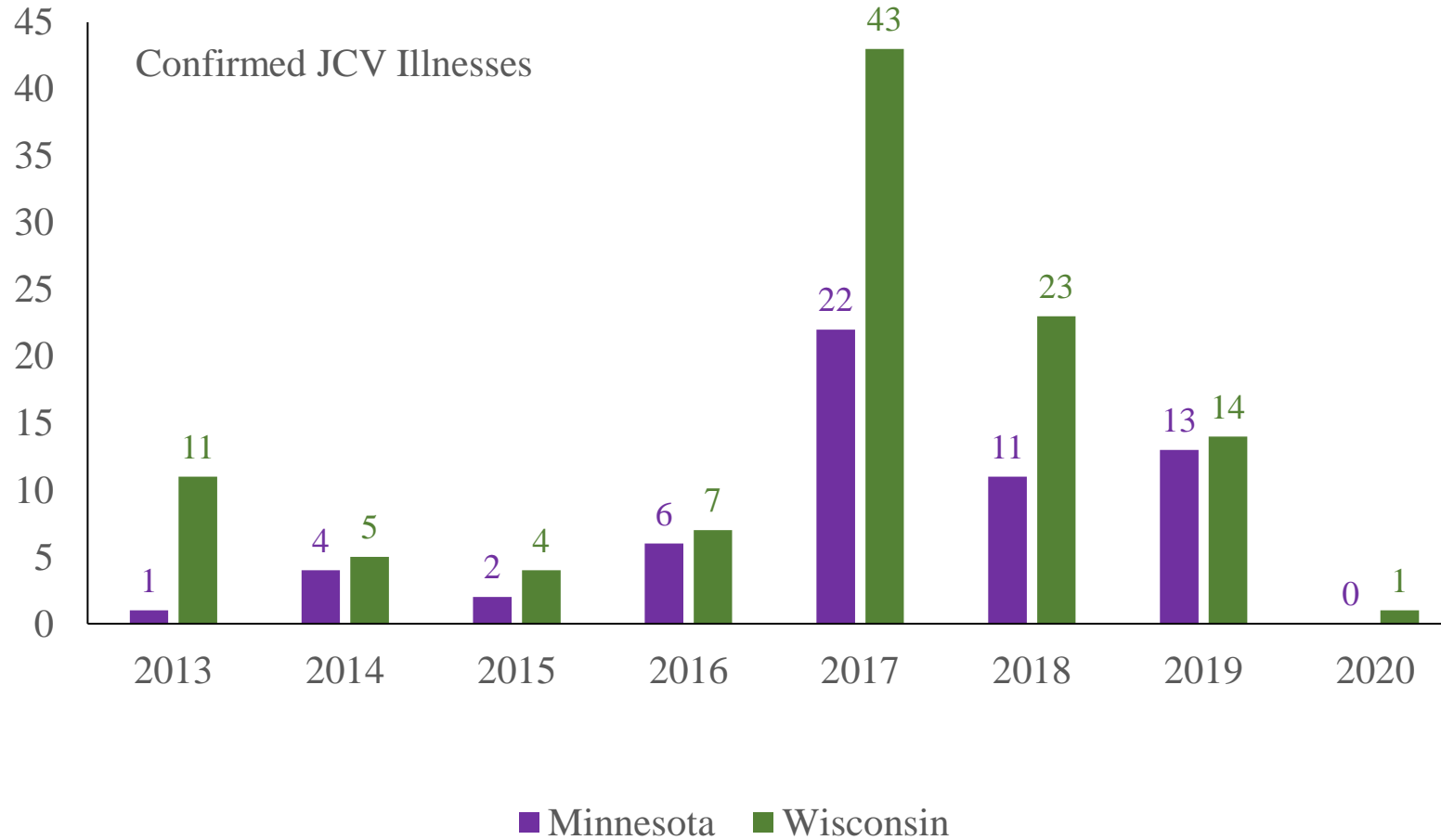
Annual Meeting of the
MMCD Technical Advisory Board
February 11, 2021

La Crosse Encephalitis

- **Prevention Efforts**
 - 2,001 Aspirator samples
 - 11,824 Tires recycled
 - 3,134 Containers eliminated
 - 375 Tree holes filled
- **72 U.S. cases**
- **Zero Minnesota cases**
- **Fourth consecutive year without a District case**



Jamestown Canyon Virus



Jamestown Canyon Virus

- 2020 JCV Surveillance
 - 88 Mosquito samples tested by UW-Madison (Banded-legged spring *Aedes* & *Ae. provocans*)
 - 1 JCV positive result (June 9)
 - *Aedes provocans*
 - Ham Lake (Anoka Co.)
 - Planned for enhanced larval surveillance
 - Weekly inspections of wetlands starting at first snow melt
 - Postponed due to COVID-19



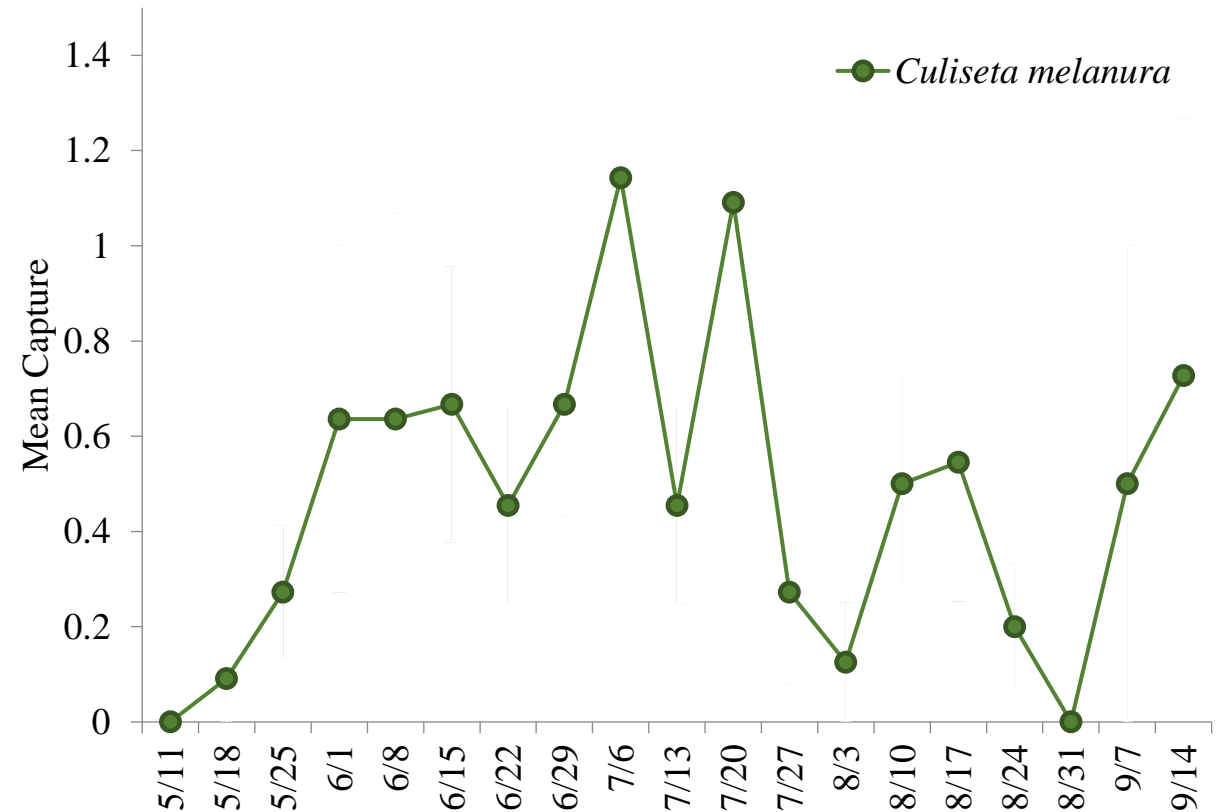
Jamestown Canyon Virus

- 2021 JCV Surveillance
 - Adult – similar to past few years
 - Coordinate with MCE-VBD
 - Larval – weekly visits to selected wetlands
 - Larval development – time/temp.
 - Attempt to ID habitat preferences
 - Want to determine if changes are required to our current spring control strategies



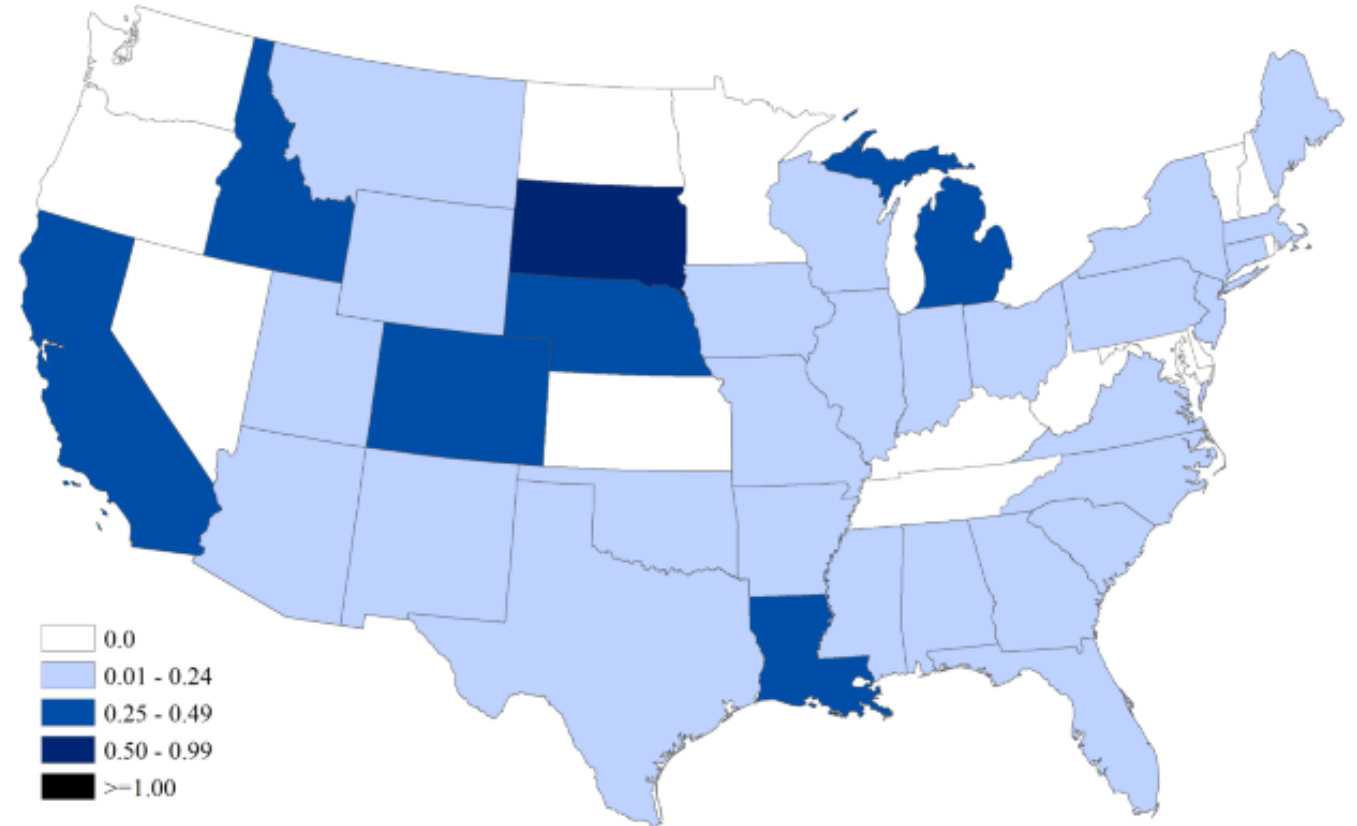
Eastern Equine Encephalitis

- Two MN EEE illnesses - horses
 - Aitkin Co., Benton Co.
- Two WI EEE illnesses - humans
 - Chippewa Co., Eau Claire Co.
 - Horse cases in 12 counties
- 19 *Cs. melanura* samples tested
 - All negative for EEE
- *Cs. melanura* population low in District



West Nile Virus

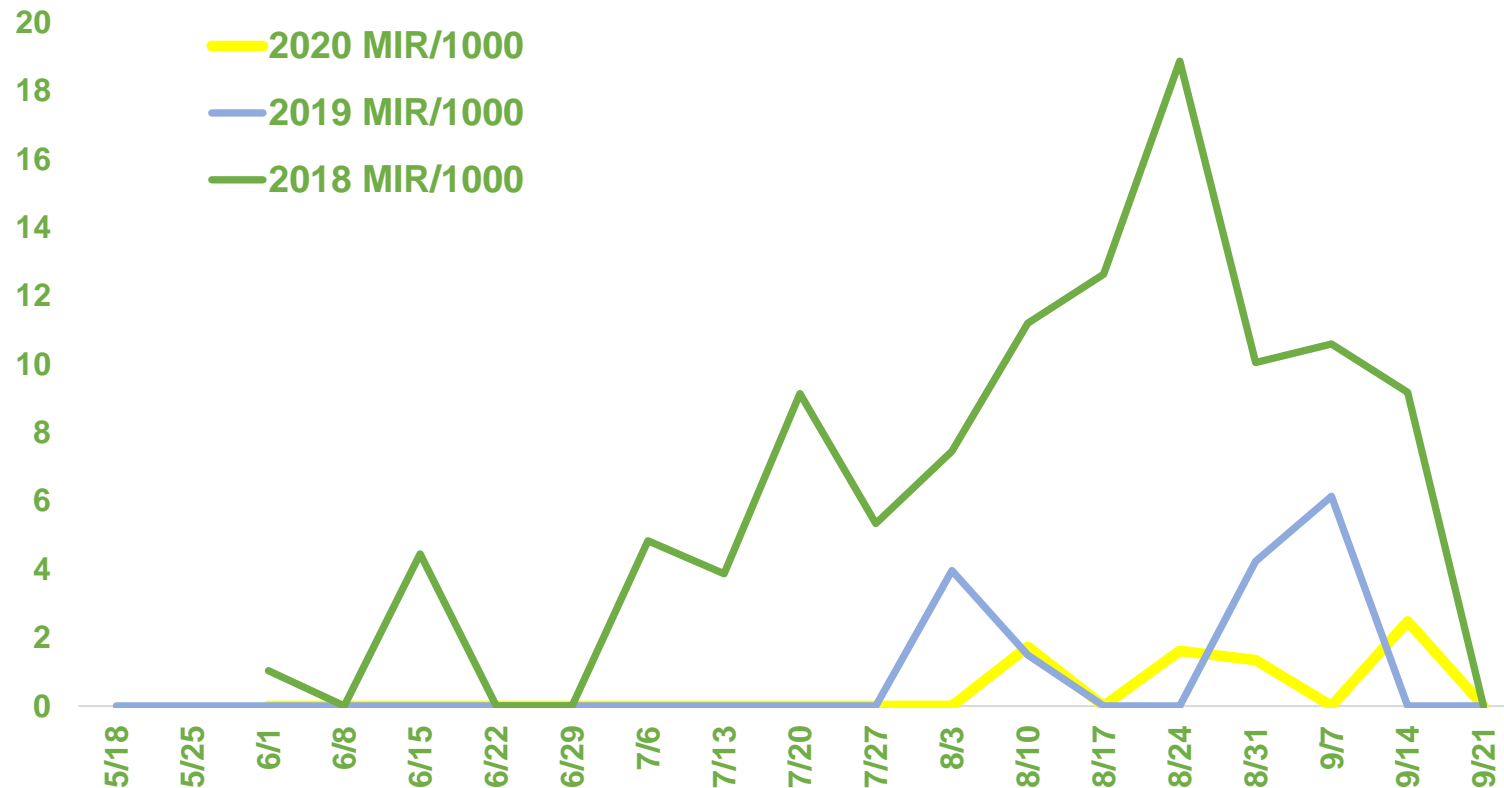
- **540 U.S. cases**
 - 33 Fatalities
 - No Minnesota cases



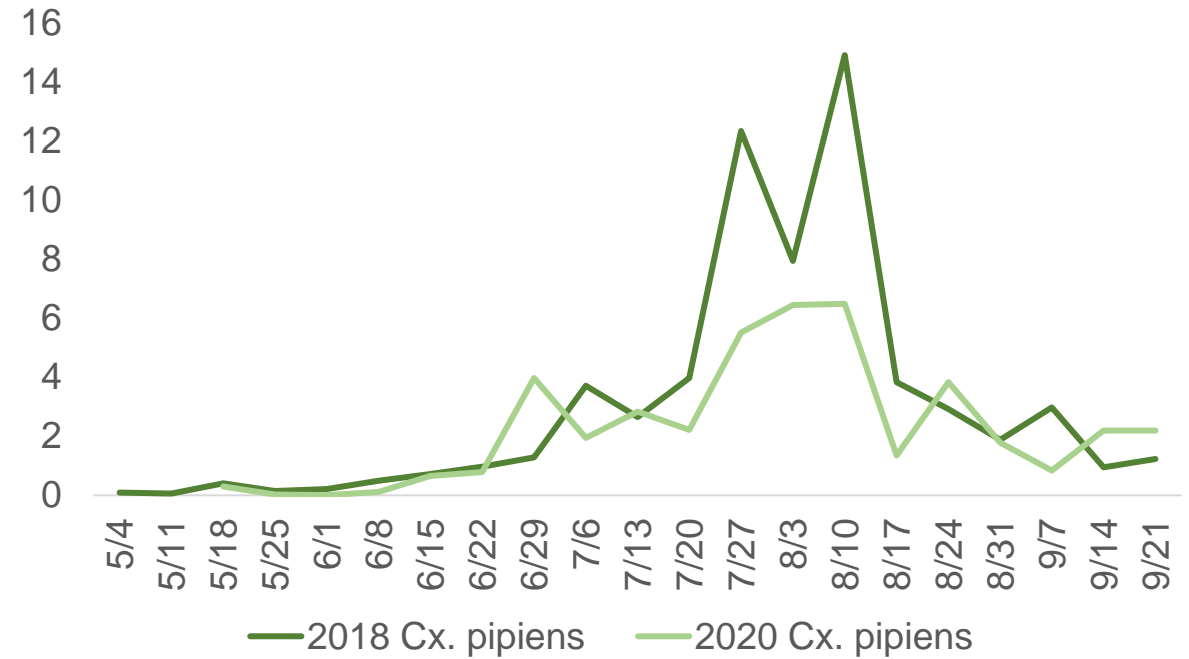
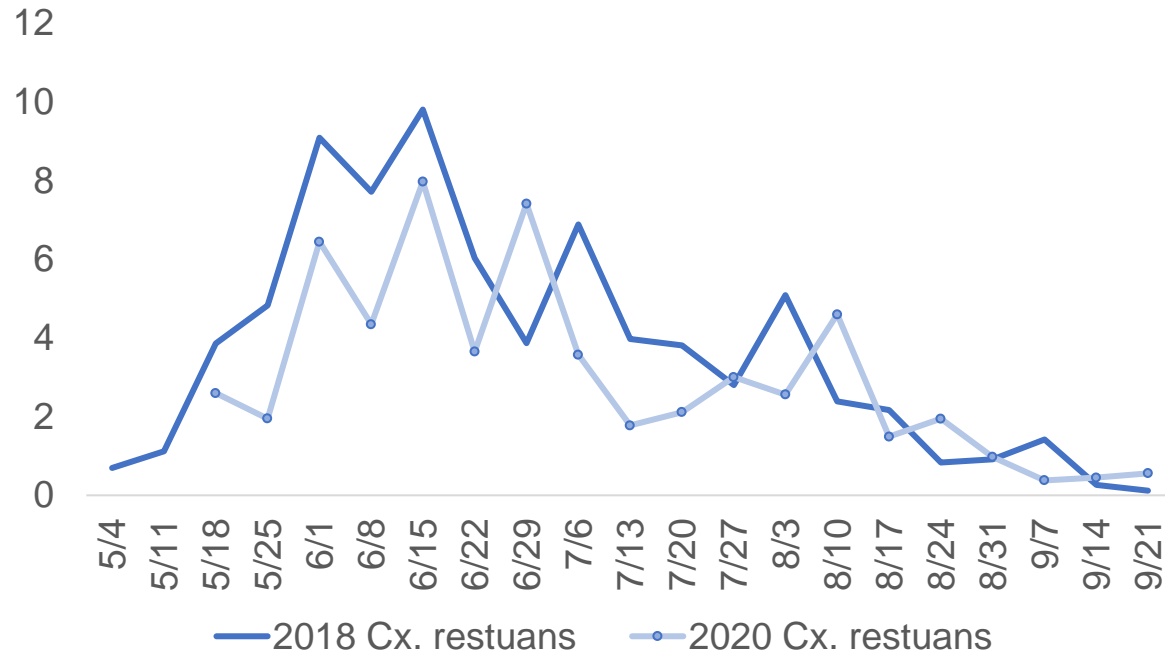
WNV neuroinvasive disease incidence per 100,000 pop.
Source – CDC ArboNET Reports

West Nile Virus

- **Six WNV positive mosquito pools of 546 tested**
 - 132 WNV positive mosquito pools in 2018, 5 in 2019

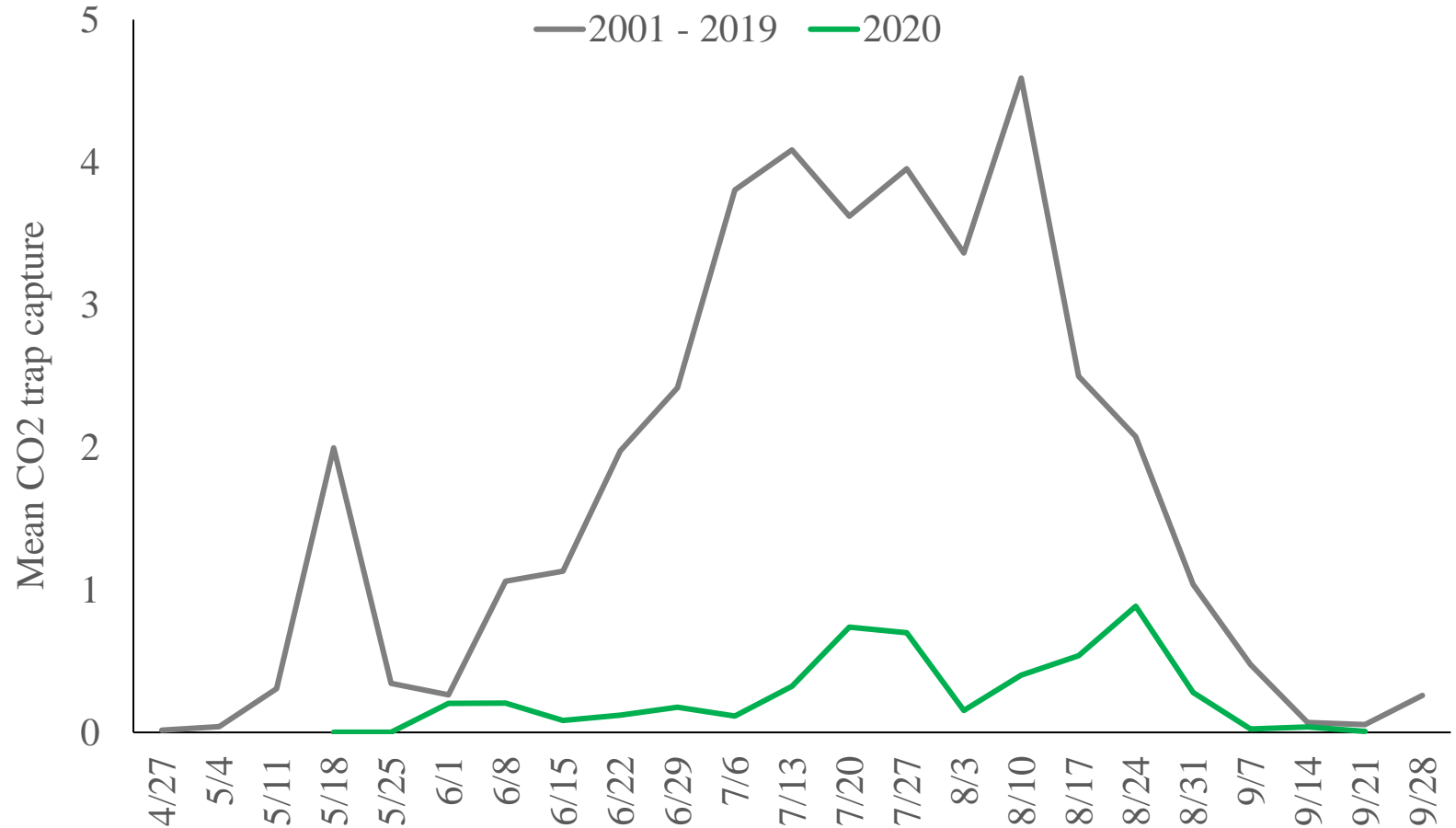


Culex pipiens & Culex restuans



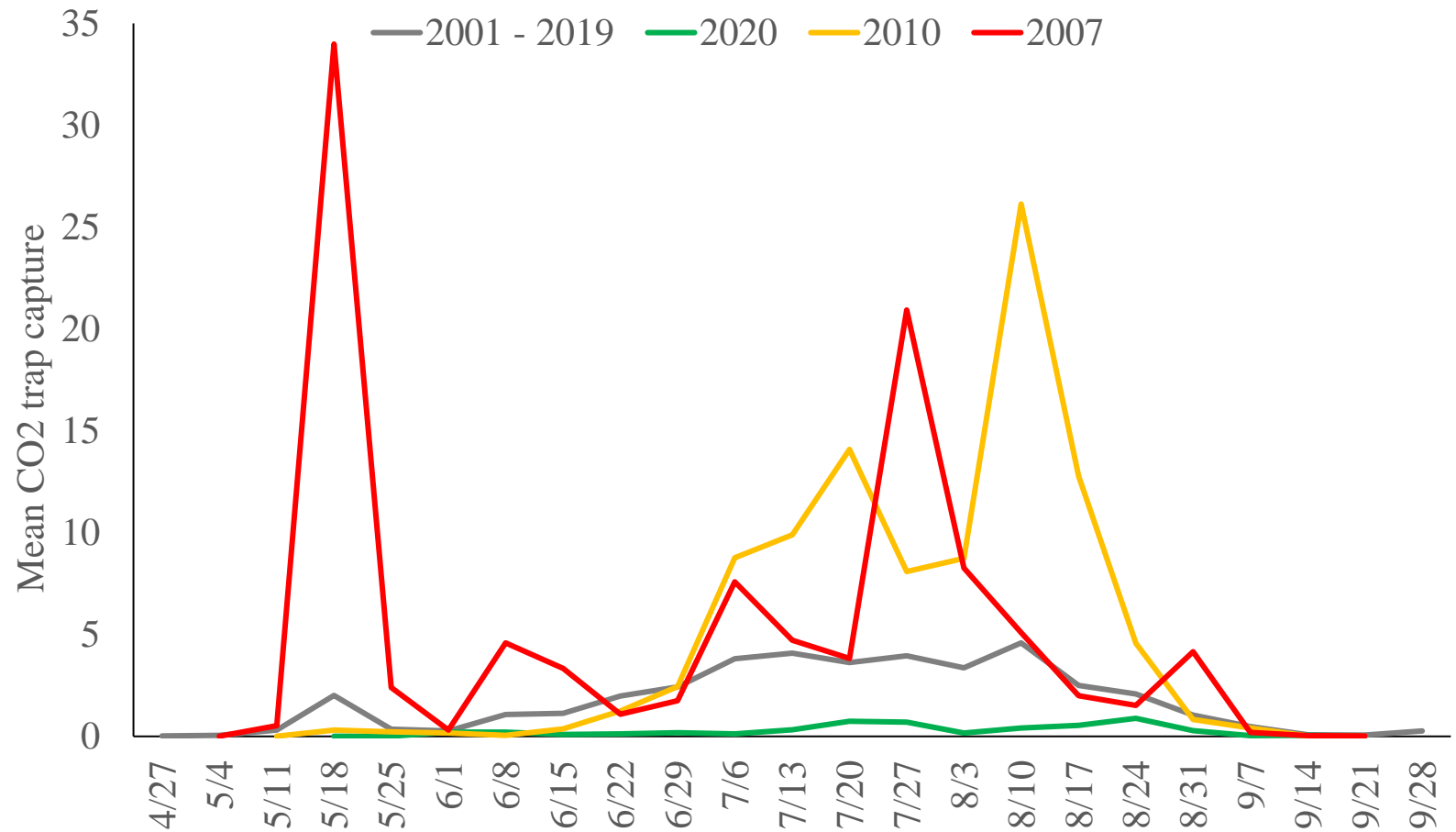
Culex tarsalis

- Low population in 2020 as measured by CO₂ traps



Culex tarsalis

- Low population in 2020 as measured by CO₂ traps



Factors leading to WNV epidemics

- Surviving population of chronically infected overwintering mosquitoes
- Naïve proportion of bird population – high
- Warm spring temperatures
- Sustained *Cx. restuans* population
- Average or above summer temperatures
- High *Cx. pipiens* population mid & late summer
- High, widespread *Cx. tarsalis* population mid & late summer



Ticks and Tick-borne Disease

MMCD Technical Advisory Board Meeting

February 11, 2021

COVID -19 impacts to tick work, 2020

- Even through all of MMCD's operational changes, tick surveillance continued as in past years.
- Except that
 - St Paul staff were utilized in the field.
 - educational materials distribution and event participation was suspended.

More COVID -19 impacts, 2020

**MN Dept of Health
impacted, too!**

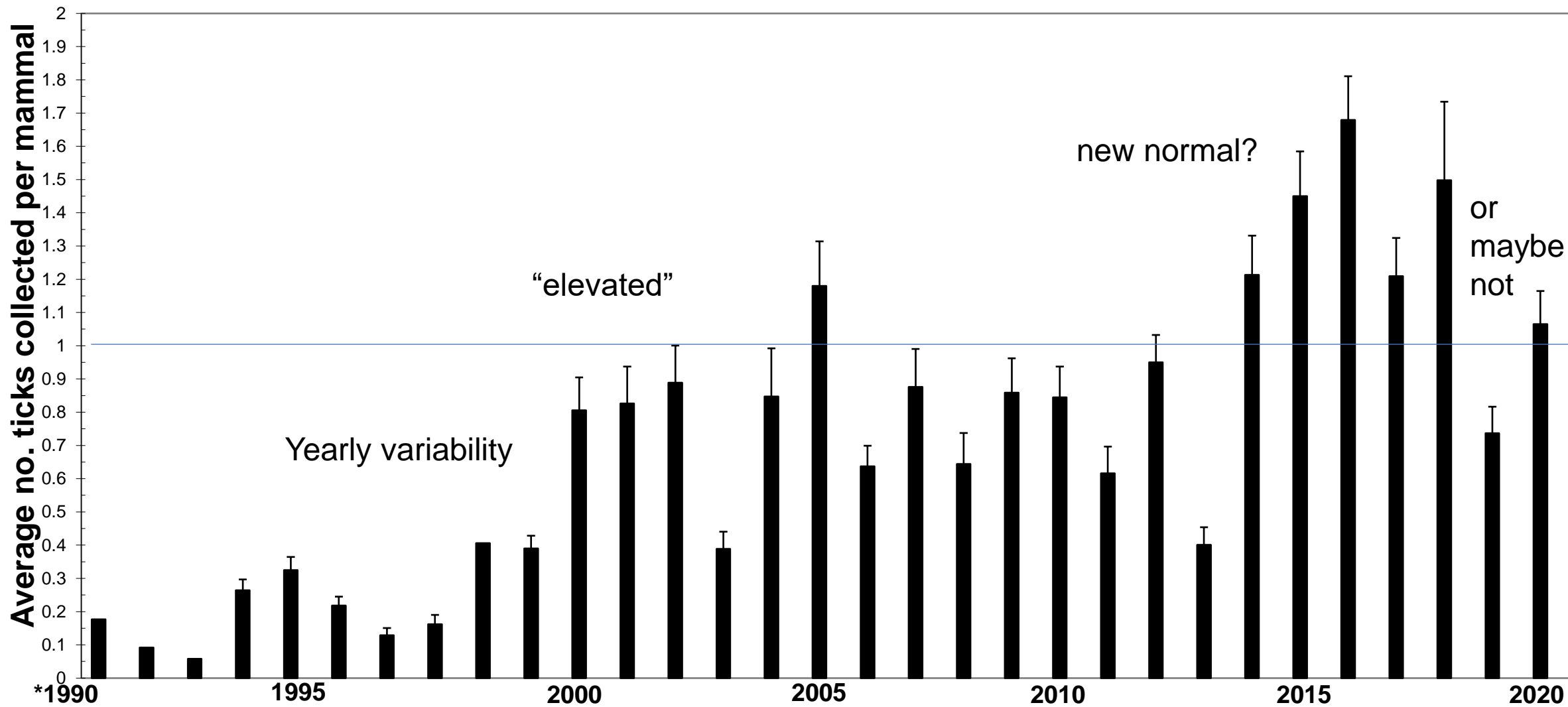


Thank you, MDH for your dedication!

2020 tick surveillance results

- 1.07 average number *I. scapularis* per mammal (1.68 in 2016 – record)
- 59 positive sites (82 in 2016 – record)

Average number of *I. scapularis* collected per mammal at 100 repeat sampling locations 1990-2020 (+1SE through 2020).



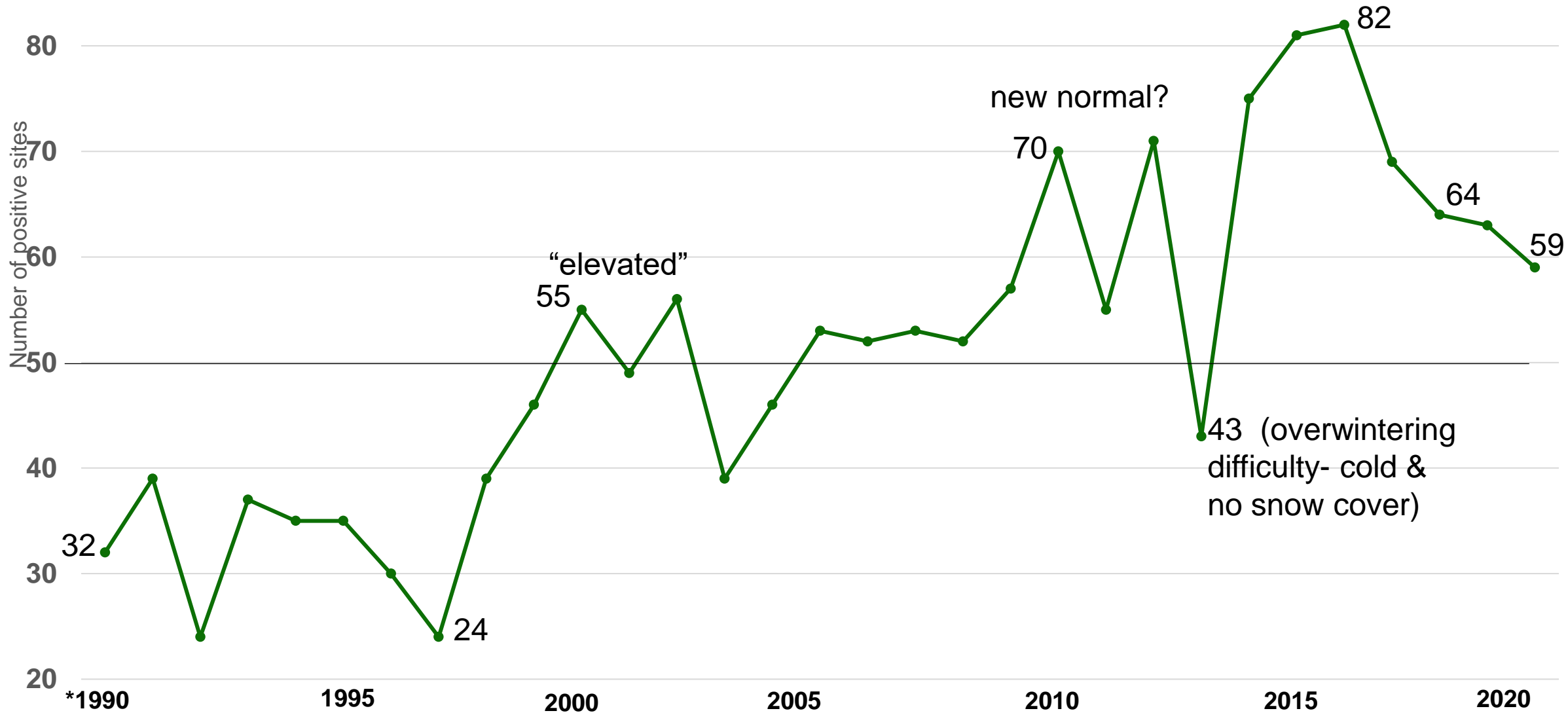
*1990

*75 sites

1 SE bars missing for 1990 - 1992 and 1998 due to unavailable master files.



Yearly number of positive sites (at least one *I. scapularis* collected) at our 100 repeat sampling locations 1990-2020



*1990

*75 sites

MMCD tick surveillance fun fact.

- We collected *Ixodes marxi* (squirrel tick) for the first time since 2007. (1 nymph; 6 larvae)
 - eerily enough, from a squirrel (*Glaucomys volans*)
southern flying squirrel

From 2008 – 2019 “other” ticks had exclusively been the one-host tick *Ixodes muris* (the mouse tick).

MIN tick-borne disease cases

2019 and 2020 not yet available

- 2018 Lyme (confirmed only) was 950.
 - median Lyme 2000-2008: 913 (range 463-1,239)
 - median Lyme 2009-2017: 1,203 (range 896-1,431)
- 2018 Anaplasmosis (confirmed + probable) was 496.
 - median anaplasmosis 2000-2009: 163 (range 76-322)
 - median anaplasmosis 2010-2017: 633 (range 488-788)

Amblyomma americanum (lone star tick)

Another COVID-19 impact?

11 ticks reported/submitted in 2020

VS

2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2	3	3	3	3	1	3	7	5	2	2

Yearly reports to MMCD & MDH combined

Exotic ticks, found in the US

- Asian longhorned tick, *Haemaphysalis longicornis*.
 - Zero found in Minnesota
- red sheep tick, *Haemaphysalis punctata*.
 - One specimen found in Rhode Island.
 - closely related to the Asian longhorned tick
 - transmits a number of pathogens that cause tick-borne diseases.

Exotic ticks, found in MN

- brown dog tick, *Rhipicephalus sanguineus*.
 - Twenty-four turned in to the MDH from Hudson, WI.
 - found around the world, usually in warmer climates
 - sporadically turned in to MMCD or the MDH, typically in numbers in the teens to twenties
 - can breed indoors, and Quickly

MMCD 2021 plans

- *Ixodes scapularis* distribution study will continue.
- Distribution of educational materials has resumed.
- Signs will be posted at dog parks, etc.
- Staff and the public will continue to be solicited to turn in any new or unusual-looking ticks.
- Staffing of informational and fair booths could resume later; presentations, too.

MMCD Black Fly

2020

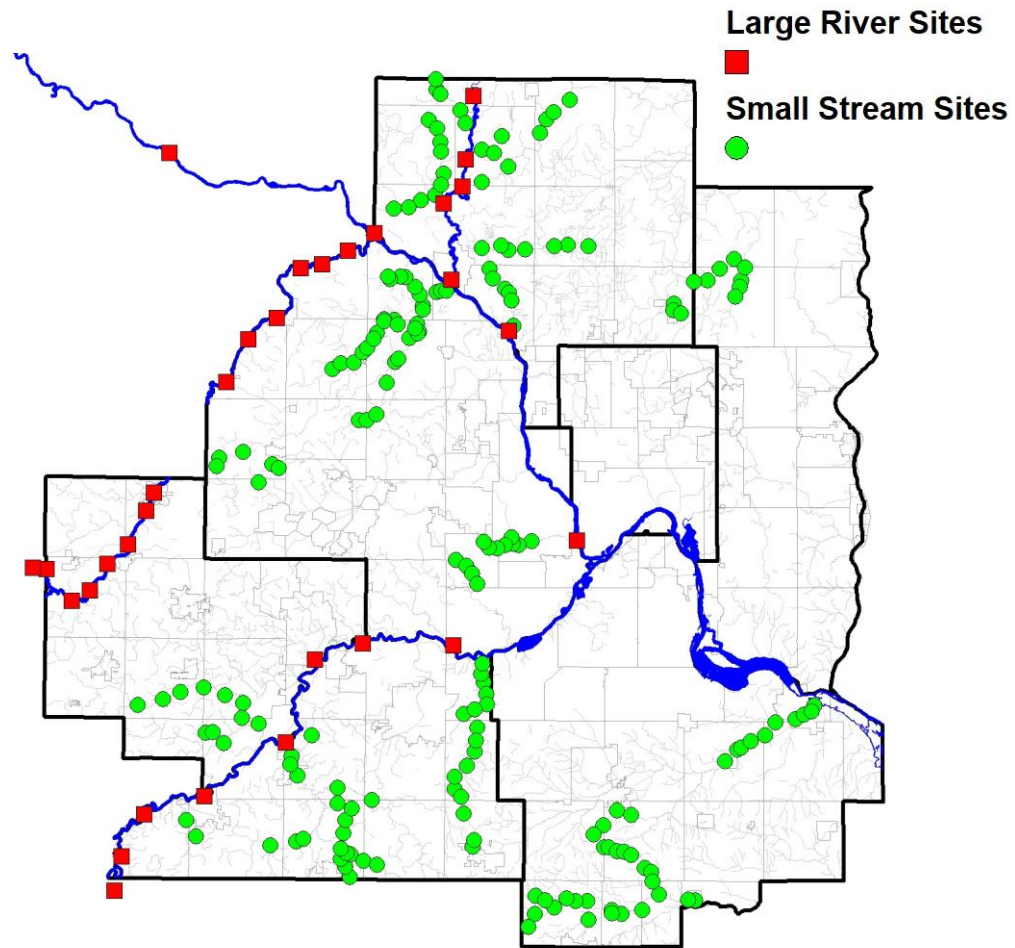
Full Report - Chapter 5



Larval Sampling/Treatment Locations



Small Stream 'Grab'



Large River 'Tape' Sampler



COVID-19 Impacts



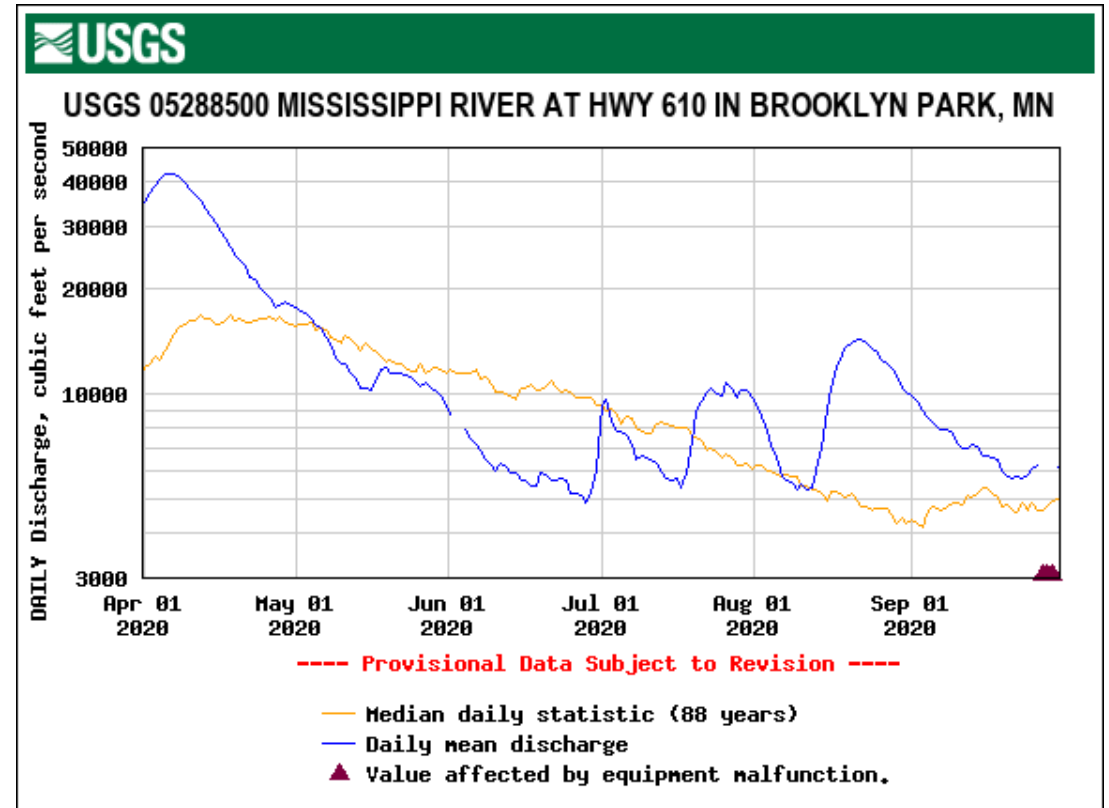
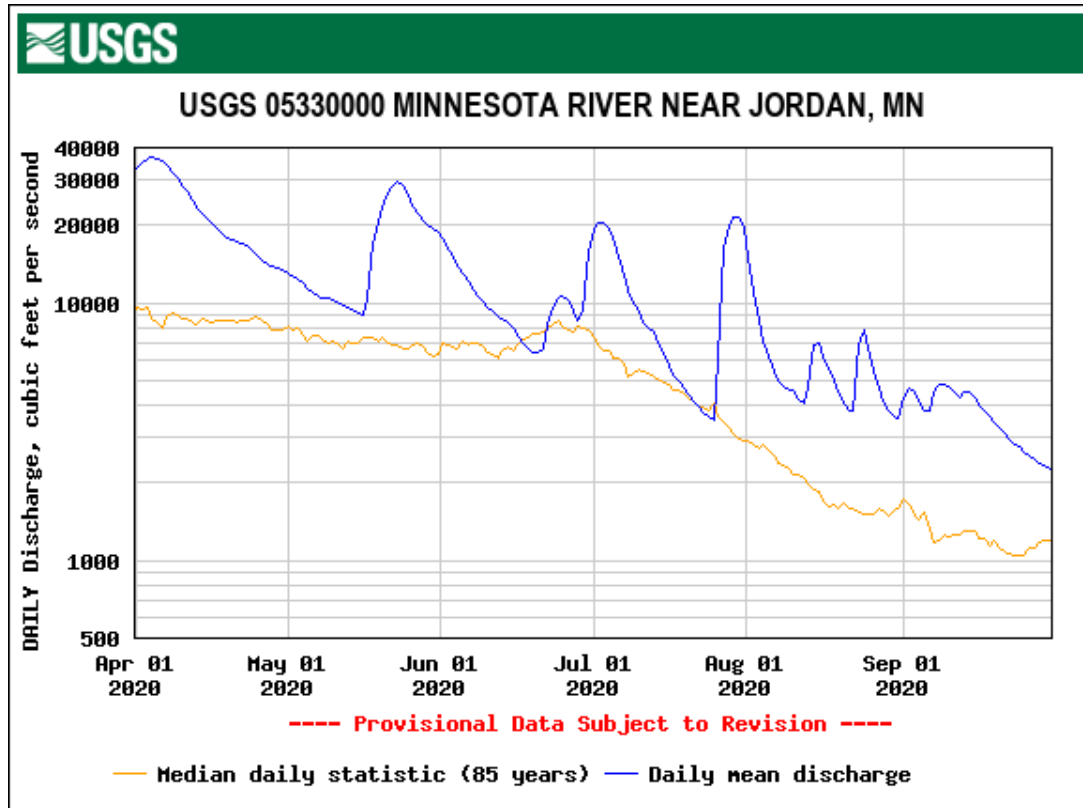
Small Streams

- Reduced due to COVID: 53 of 188 permit sites chosen
 - Most historically productive *S. venustum* streams
 - Permit Addendum sites on Minnehaha, Nile Mile, and Vermilion to get site history information
 - Only full-time staff available to collect samples in April
 - One full-time lab staff processed all samples for social distancing reasons

Large Rivers

- Minimal impact
 - One person / truck

2020 April-September River Flows



2020 Season – Treatments

Small Streams

- **2020: 43.1 gallons (29 treatments)**
- 1996-2019 average: 27.8 gallons (45 treatments)

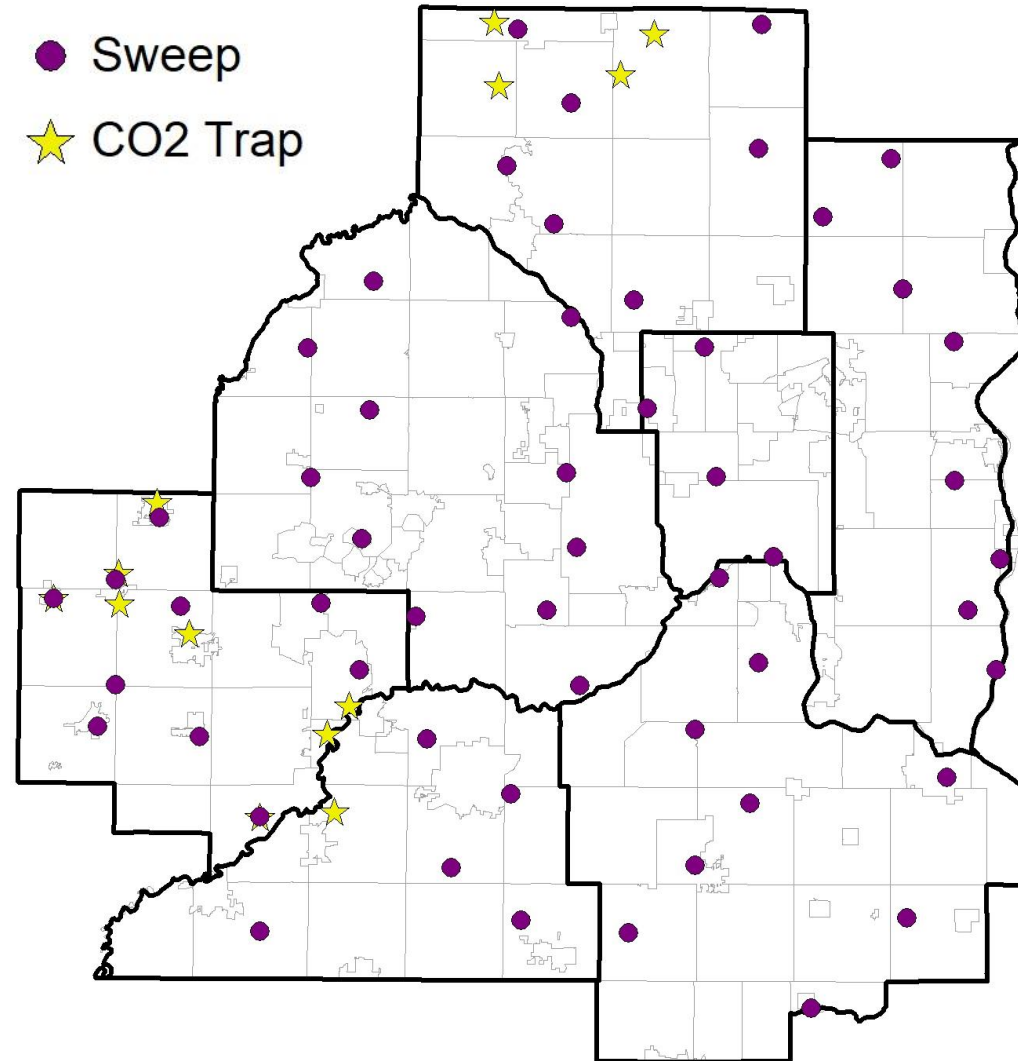


Large Rivers

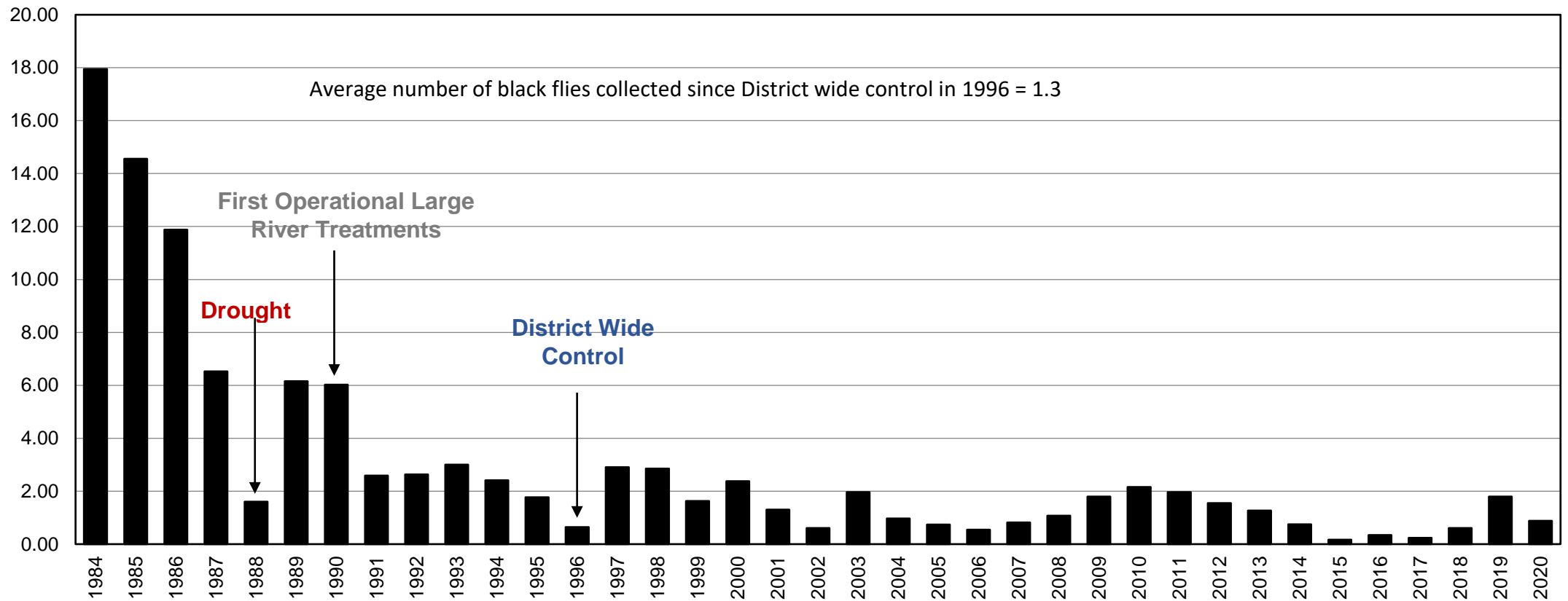
- **2020: 4,042 gallons (72 treatments)**
- 1996-2019 average: 3,204 gallons (59 treatments)



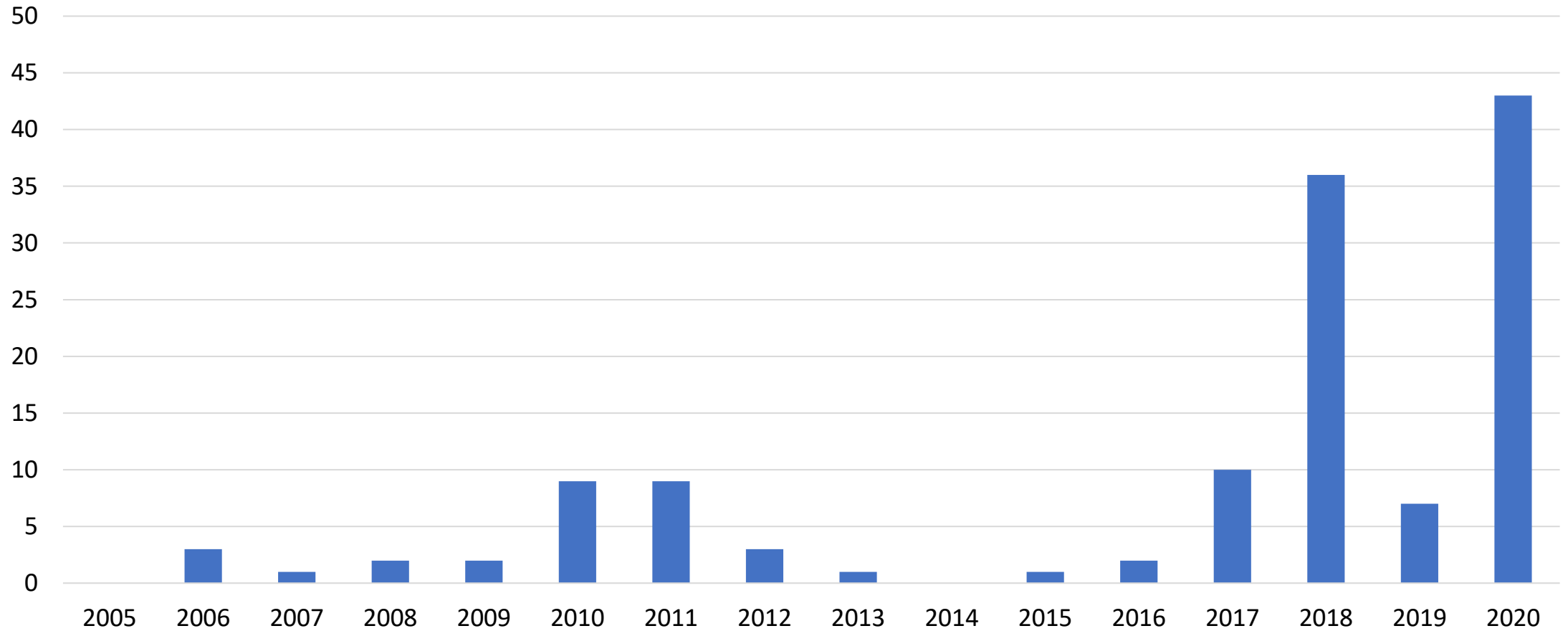
Adult Sampling Locations



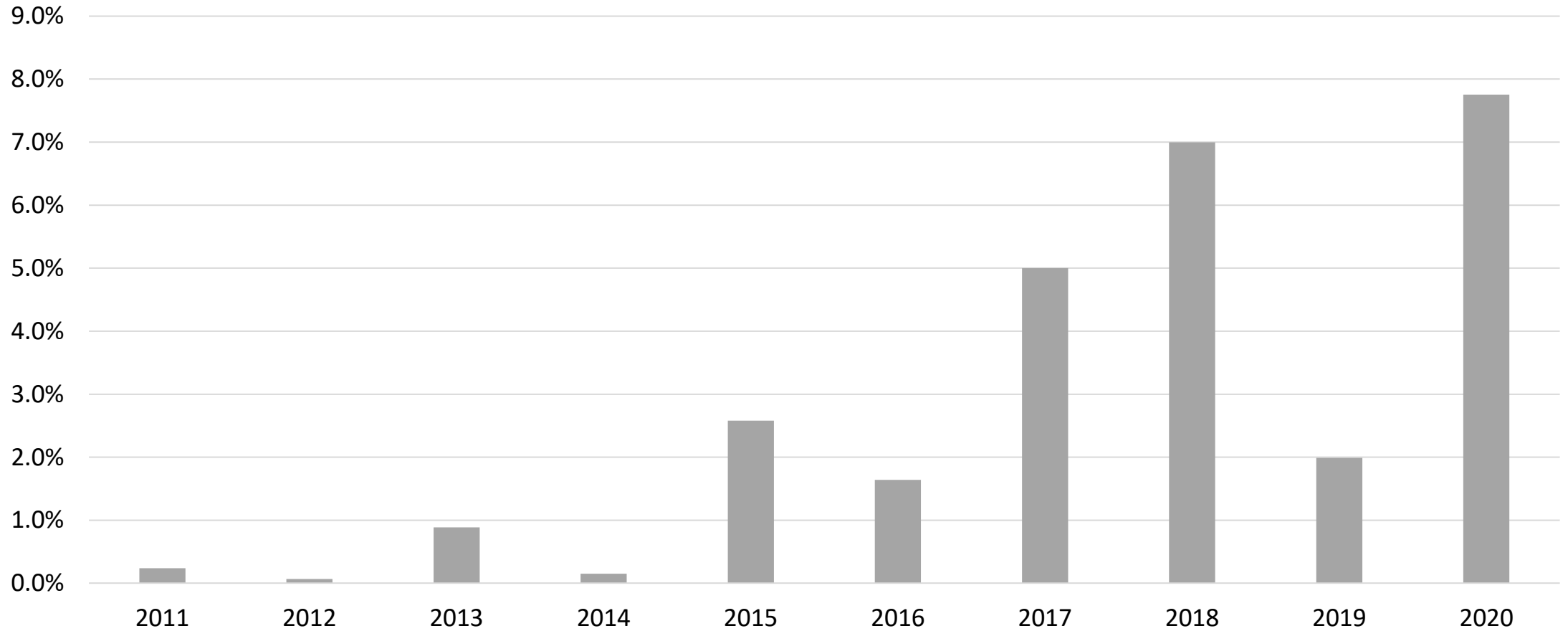
Daytime sweep net collections, 1984-2020



Black Fly Annoyance Customer Complaints, 2005-2020



% *S. tuberosum* collected in network sweeps, 2011-2020



2020 Media Attention

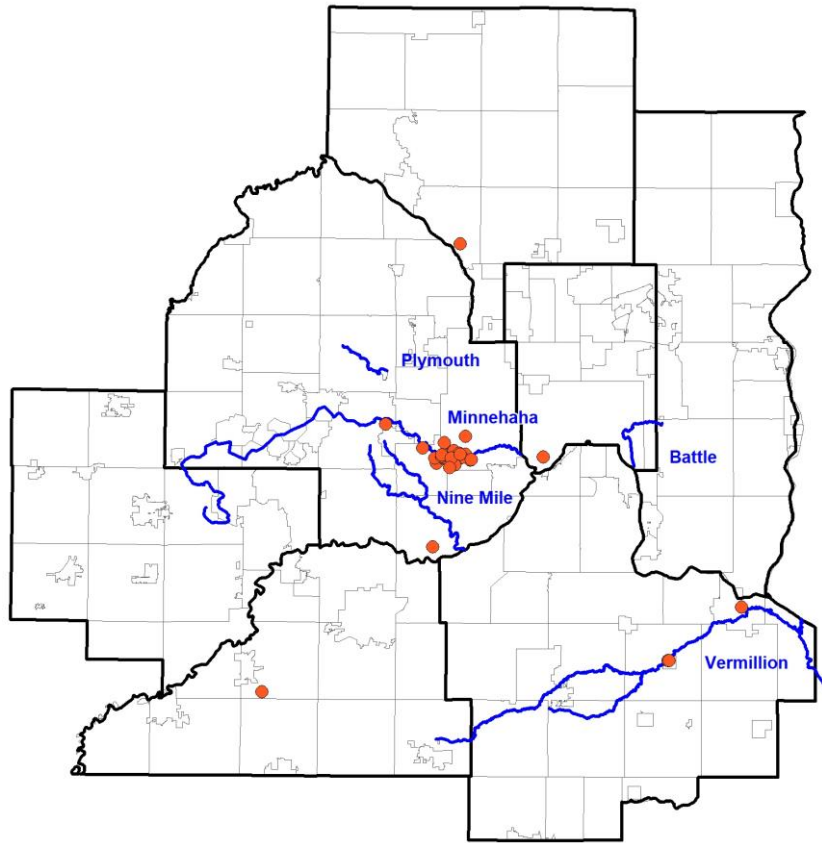
- Fox 9 - <https://www.fox9.com/news/new-aggressive-gnat-species-feasting-on-minnesotans-this-spring>
- MPR News - <https://www.mprnews.org/story/2020/05/14/first-a-pandemic-and-now-biting-gnats>
- WCCO - <https://minnesota.cbslocal.com/2020/05/14/are-this-years-gnats-worse-than-in-the-past/>
- KSTP - <https://kstp.com/minnesota-news/human-biting-small-stream-gnat-species-unable-to-be-treated-2020/5729442/>
- Bring Me the News - <https://bringmethenews.com/minnesota-lifestyle/new-species-of-gnats-bugging-people-in-the-twin-cities>
- Star Tribune - <https://www.startribune.com/now-what-gnats-black-fly-invasion-torments-twin-cities/570520362/?refresh=true>
- KARE 11 - <https://www.kare11.com/article/news/health/aggressive-black-flies-now-in-the-twin-cities/89-a3fb0970-1d34-44db-af57-39d2e5b8a386>
- Belle Plaine Herald - http://www.belleplaineherald.com/news/don-t-get-bugged-by-black-flies-gnats/article_b8d09338-96d7-11ea-a483-cb58b00e8422.html



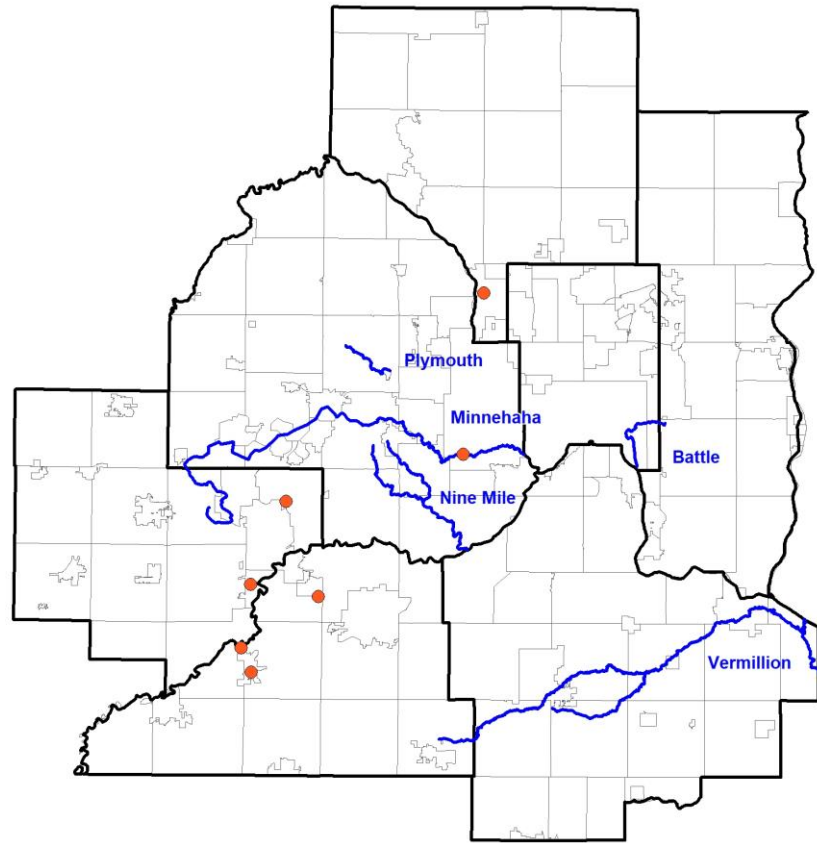
Simulium tuberosum

- Not a new species
- Been identified since 1984 in very low numbers
- Never been on the MN DNR Permit

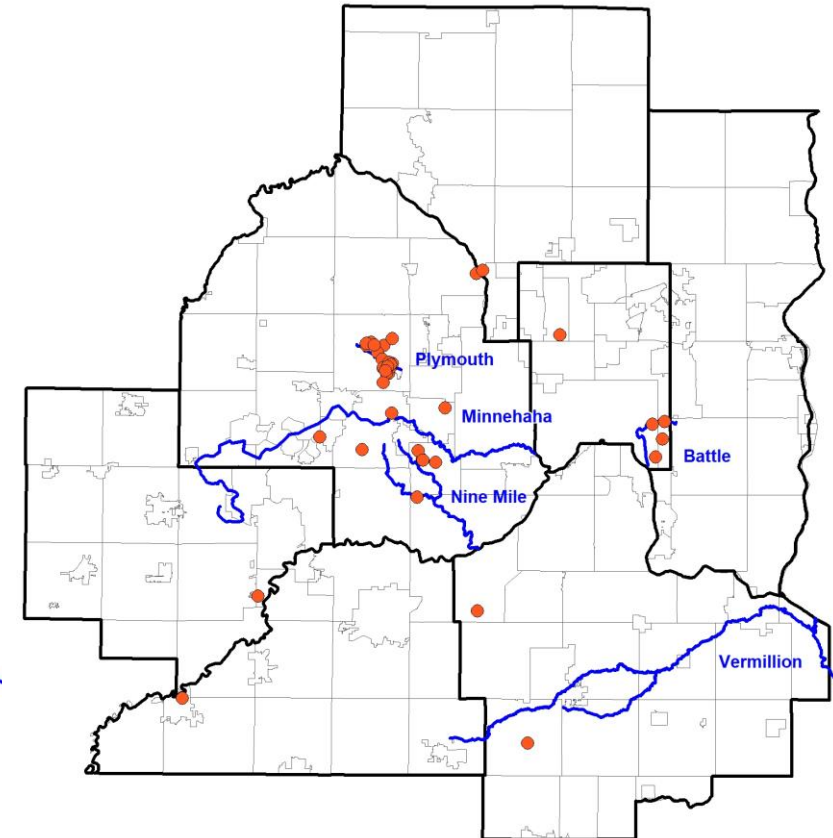
Location of Black Fly Annoyance Complaints: 2018, 2019 and 2020



2018



2019



2020

2020 – Focused Sampling

- Nine Mile Creek (Henn Co.) – *S. tuberosum*
- Minnehaha Creek (Henn Co.) – *S. tuberosum*
- Plymouth Creek (Henn Co.) – *S. tuberosum*
- Battle Creek (Ramsey Co.) – *S. tuberosum*

2021 Plans

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ECOLOGICAL AND WATER RESOURCES
PERMIT: BF20R3-1 DATE: 26 March 2020

TO WHOM IT MAY CONCERN: Permission is hereby granted to:

Metropolitan Mosquito Control District
2099 University Avenue West
St. Paul, Minnesota 55104-3431

to apply Vectobac-12AS (EPA Reg No. 73049-38) to the listed sites on the attached streams and rivers. The following conditions apply:

Applications to sites in Table 1 and Addendum 1

- a. Standardized sampling will be conducted with a larval threshold of 100 *Simulium venustum* necessary for treatment.
- b. Second treatments will be allowed only if check backs done within 24 hours yield live larvae exceeding threshold levels.

Applications to sites in Table 2

- a. Standardized tape sampling will be conducted with larval thresholds of 100 *Simulium luggeri* or 40 *S. meridionale* and/or *S. johannseni* necessary for treatment.
- b. Efficacy sampling must be conducted at all treatment sites
- c. The DNR must be notified 24 hours prior to all treatments
- d. Maximum dosage will not exceed 25 ppm.
- e. When using the Luce Line Trail Bridge for applications (South Fork Crow River, site SFC 6) the MMCD must observe all trail regulations. No motorized vehicles of any type are permitted for use on the trail. Usage of the bridge must not block or interfere with normal usage of the bridge by other trail users.

The permittee will continue the non-target monitoring program established for the Mississippi River. The permittee will also provide a report on the number of treatments and the amount of control material applied to all sites in 2020 as a condition for a permit in 2021.

The issuance of this permit does not release the permittee from compliance requirements under any other state programs which may apply. This permit is valid from the date of issuance through December 31, 2020, but may be revoked by the commissioner at any time if he deems it necessary for the protection of public water, wild animals, and natural resources.



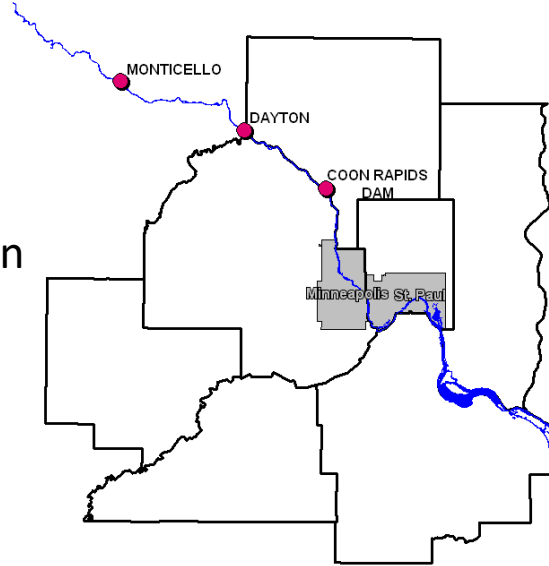
STEVE COLVIN, DIRECTOR
DIVISION OF ECOLOGICAL AND WATER RESOURCES

c: Keith Parker, Director - Central Region
Gary Montz, Research Scientist 2

- Work with MN DNR regarding *S. tuberosum* issue
- Submit request for permit addendum to MN DNR
- Continue focused sampling – larval and adult

Non-target Monitoring - Hester-Dendy Multiplates

Samples placed monthly between
May-Sept at 3 locations
(2 treated-sites, 1 control-site)



14-plate vs. 7-plate

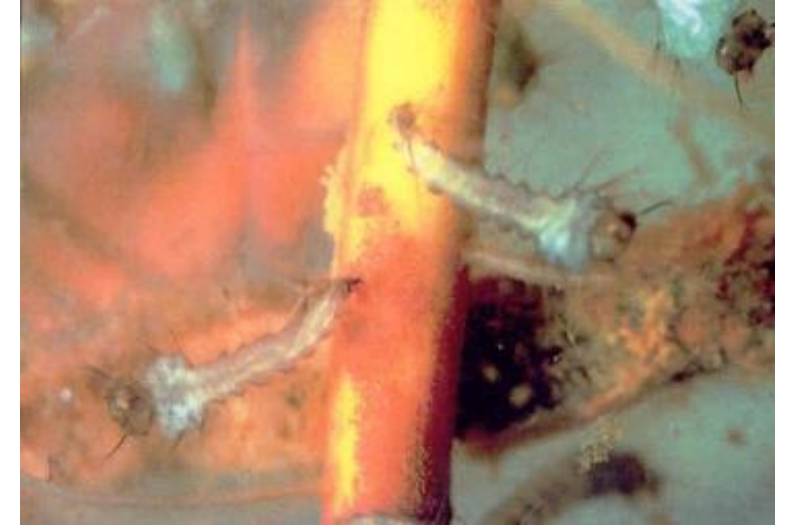
Results from the monitoring work done between 1995 and 2017 indicate that there have been no large-scale changes in macroinvertebrate community in the *Bti*-treated reaches of the Mississippi River.

Monitoring samples were collected from the Mississippi River in 2019. That report will be completed spring of 2021. Samples will be taken again on the Mississippi River in 2021.

Thanks!



Efficacy Tests



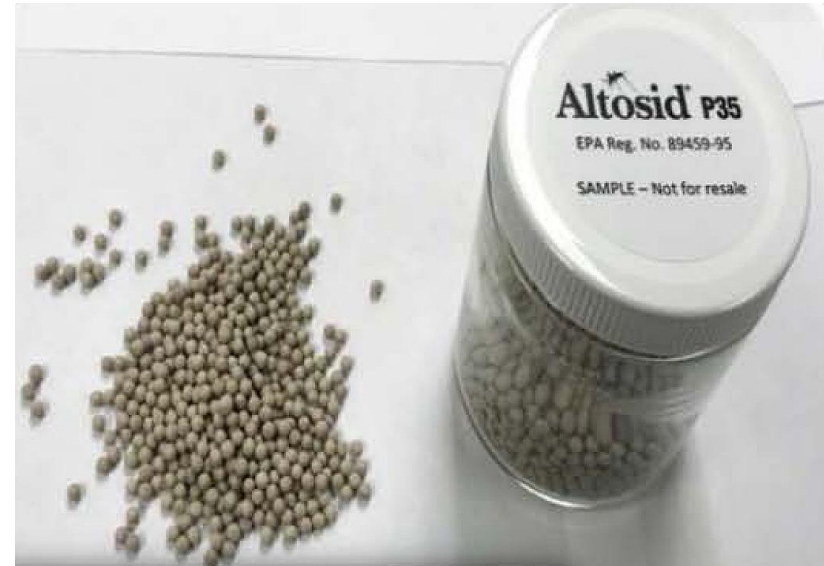
Altosid[®] P35

Cq. perturbans
2019-2020



Altosid[®] P35

- Altosid[®] P35 is a new spherical granule to replace Altosid[®] pellets
- Methoprene content (4.25%) is the same as in Altosid[®] pellets and MetaLarv[®] S-PT
- Can be applied aerially at 3 lb/acre (Altosid[®] pellet minimum aerial rate is 4 lb/acre), same as MetaLarv[®] S-PT
- Could allow MMCD to treat more acres for a comparable material cost compared to Altosid[®] pellets



Cattail (*Coquillettidia perturbans*)

- Goal of these tests was to evaluate effectiveness of Altosid® P35
- Applied Altosid® P35 at 3 lb/acre (same dosage as operational MetaLarv® S-PT treatments) in small cattail sites
- Effectiveness was evaluated by comparing how many adult mosquitoes emerged per cage when during the sampling period
- Results of test conducted in 2019 were promising; product appeared effective starting about ten days after treatment
- This test was repeated in 2020 to verify that Altosid® P35 was effective beginning about ten days after treatment

Cattail

Effectiveness measured by emergence of adult *Cq. perturbans* in emergence cages

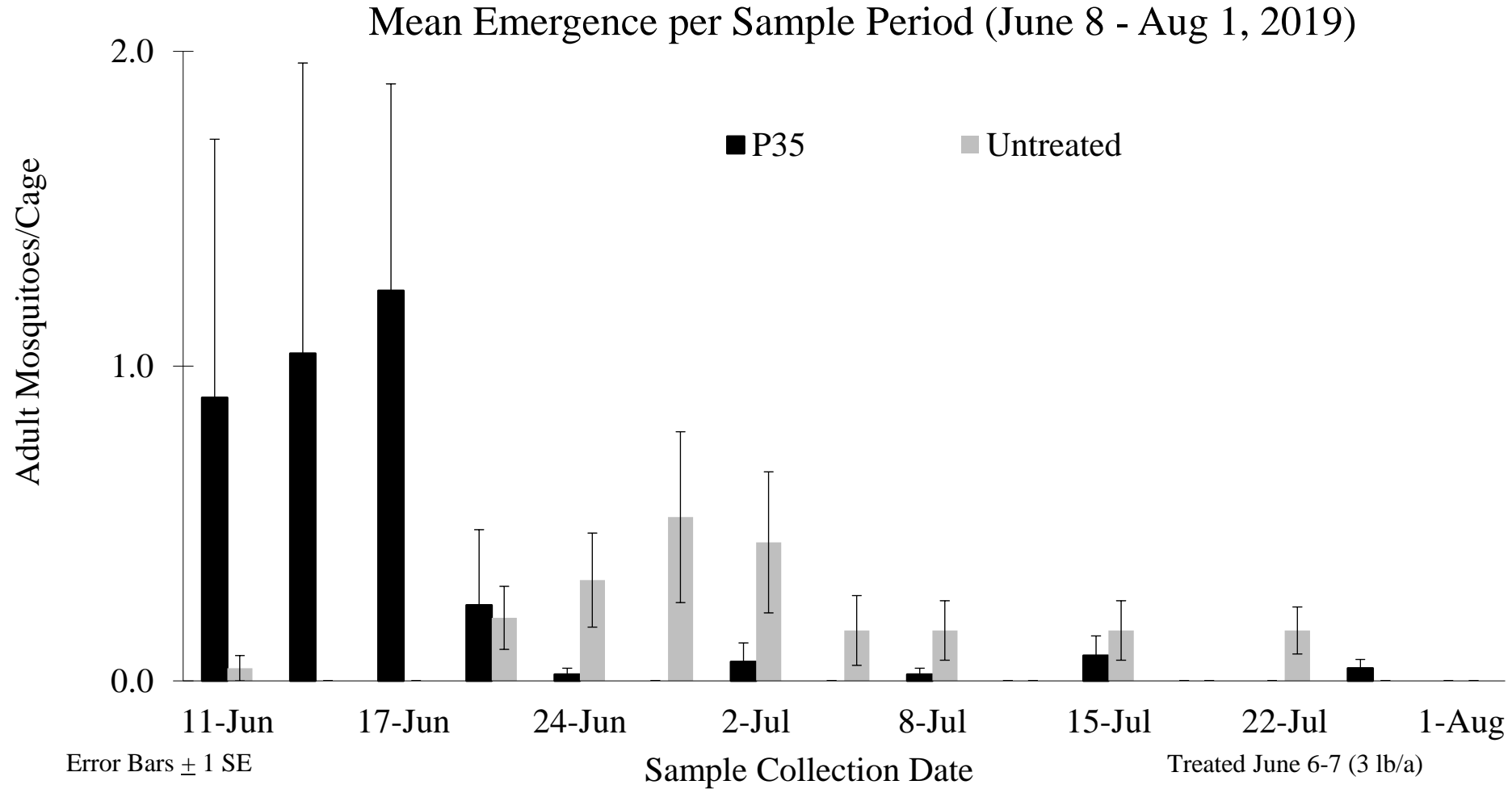


Cattail (*Coquillettidia perturbans*)

- Initial (2019) test
- Treated ten ground sites on June 6-7, 2019 with 3 lb/acre (same dosage as operational MetaLarv[®] S-PT treatments)
- On June 8, 2019 five emergence cages were placed in each of the ten treated and five untreated sites
- Adult *Cq. perturbans* were collected twice each week beginning on June 11 through August 1, 2019
- Effectiveness was evaluated by comparing how many adult mosquitoes emerged per cage when during the sampling period

Cattail

Altosid® P35 (3-lb/acre) appeared to control *Cq. perturbans* in ground sites (2019)



Cattail

Altosid[®] P35 (3-lb/acre) appeared to control *Cq. perturbans* in ground sites (2019)

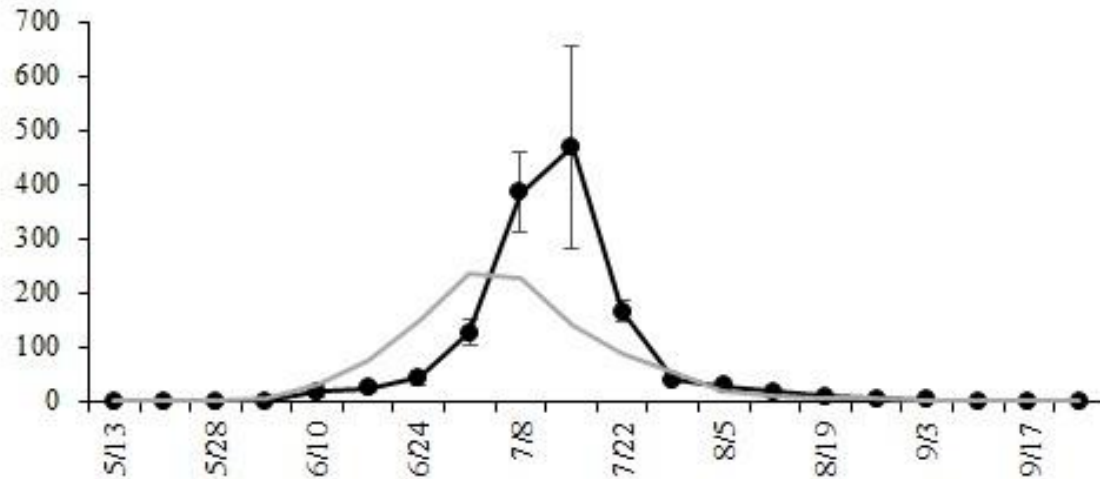
Sample Period	Treatment	Total Cages	Cages with Emergence	Cages without Emergence	% Cages with Emergence	Fisher Exact P-value
8 June – 1 Aug	Untreated	25	17	8	68%	0.00156
	Altosid [®] P35	50	15	35	30%	
17 June – 1 Aug	Untreated	25	17	8	68%	0.0000014
	Altosid [®] P35	50	6	44	12%	

Altosid[®] P35 (3-lb/acre) applied on June 6-7

Cattail

Altosid[®] P35 (3-lb/acre) appeared to control *Cq. perturbans* in ground sites (2019)

Cq. perturbans in CO₂ Traps
(District wide)



Black line = 2019 (mean ± SE)

Gray line = 19-year mean

- Dates of emergence in untreated sites very similar to District-wide 2019 CO₂ trap average
- 87% of emergence from treated sites occurred within ten days after treatment
- 2% of emergence from untreated sites occurred within ten days after treatment
- Emergence from significantly fewer cages in treated sites

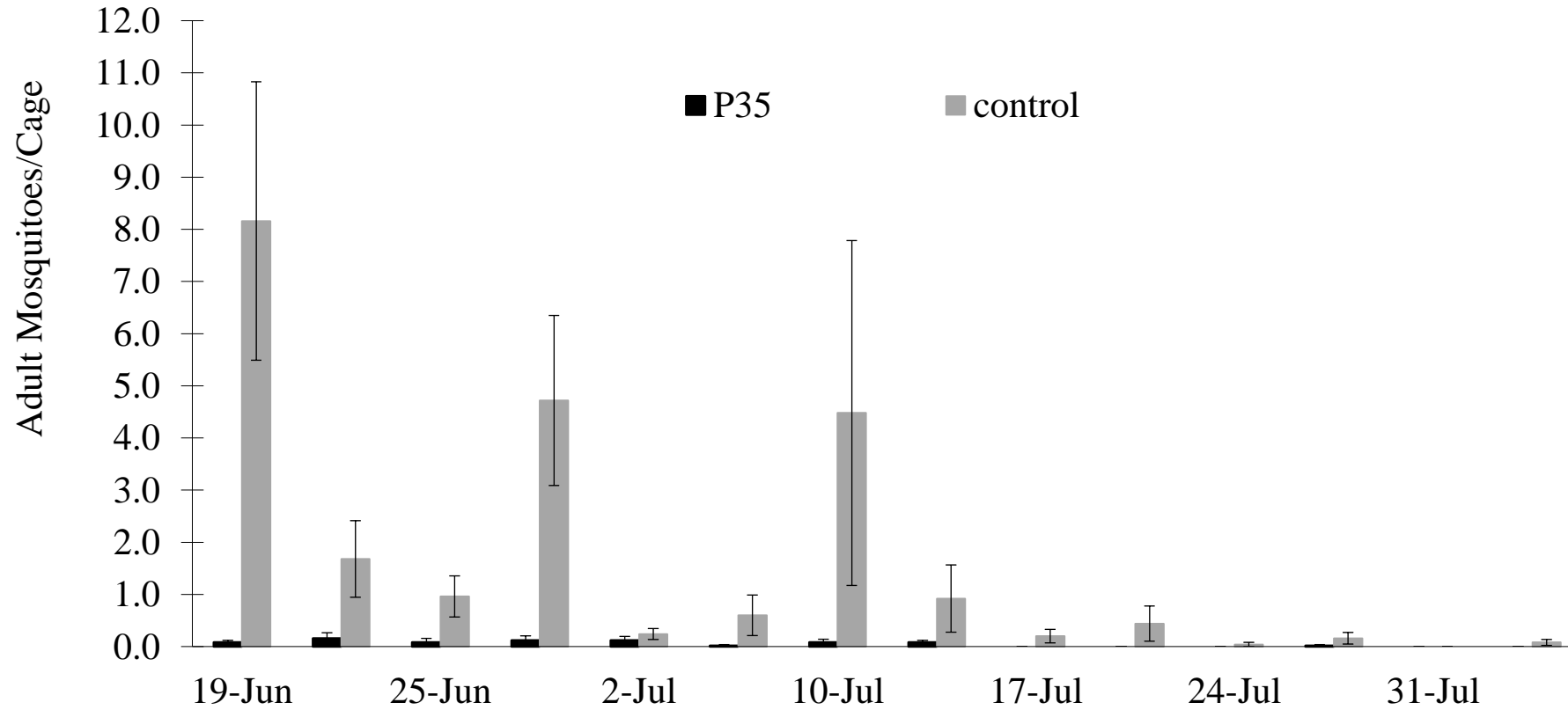
Cattail (*Coquillettidia perturbans*)

- Repeat (2020) test
- Treated ten ground sites on June 2-3, 2020 with 3 lb/acre (same dosage as operational MetaLarv[®] S-PT treatments)
- On June 15, 2020 five emergence cages were placed in each of the ten treated and five untreated sites
- Adult *Cq. perturbans* were collected twice each week beginning on June 19 through August 4, 2020
- Effectiveness was evaluated by comparing how many adult mosquitoes emerged per cage when during the sampling period

Cattail

Altosid[®] P35 (3-lb/acre) appeared to control *Cq. perturbans* in ground sites (2020)

Mean Emergence per Sample Period (June 15 - Aug 4, 2020)



Error Bars \pm 1 SE

Sample Collection Date

Treated June 2-3 (3 lb/a)

Cattail

Altosid[®] P35 (3-lb/acre) appeared to control *Cq. perturbans* in ground sites (2020)

Sample Period	Treatment	Total Cages	Cages with Emergence	Cages without Emergence	% Cages with Emergence	Fisher Exact P-value
15 June – 4 Aug	Untreated	25	19	6	76%	
	Altosid [®] P35	50	15	35	30%	0.00016

Altosid[®] P35 Mean Cumulative Emergence = 0.76 mosquitoes/cage

Untreated = 22.7 mosquitoes/cage (96.6% control)

2021 Plans

- Use Altosid[®] P35 to treat all cattail acres formerly treated aurally with Altosid[®] pellets to treat more acres for a comparable material cost
- Test Altosid[®] P35 in cattail sites that were treated with the drone (3 lb/acre)
- Treat ten days before first day of sampling

VectoLex[®] FG Efficacy in Catch Basins

Annual Meeting of the MMCD
Technical Advisory Board
February 11, 2021

VectoLex[®] FG

- VectoLex[®] FG is a granular formulation of *Bacillus sphaericus* 2362 (strain ABTS-1743) for residual control of mosquito larvae
- VectoLex[®] FG offers extended control of all *Culex* species
- VectoLex[®] FG provides up to 28 days or residual control (according to product label)
- Different active than methoprene



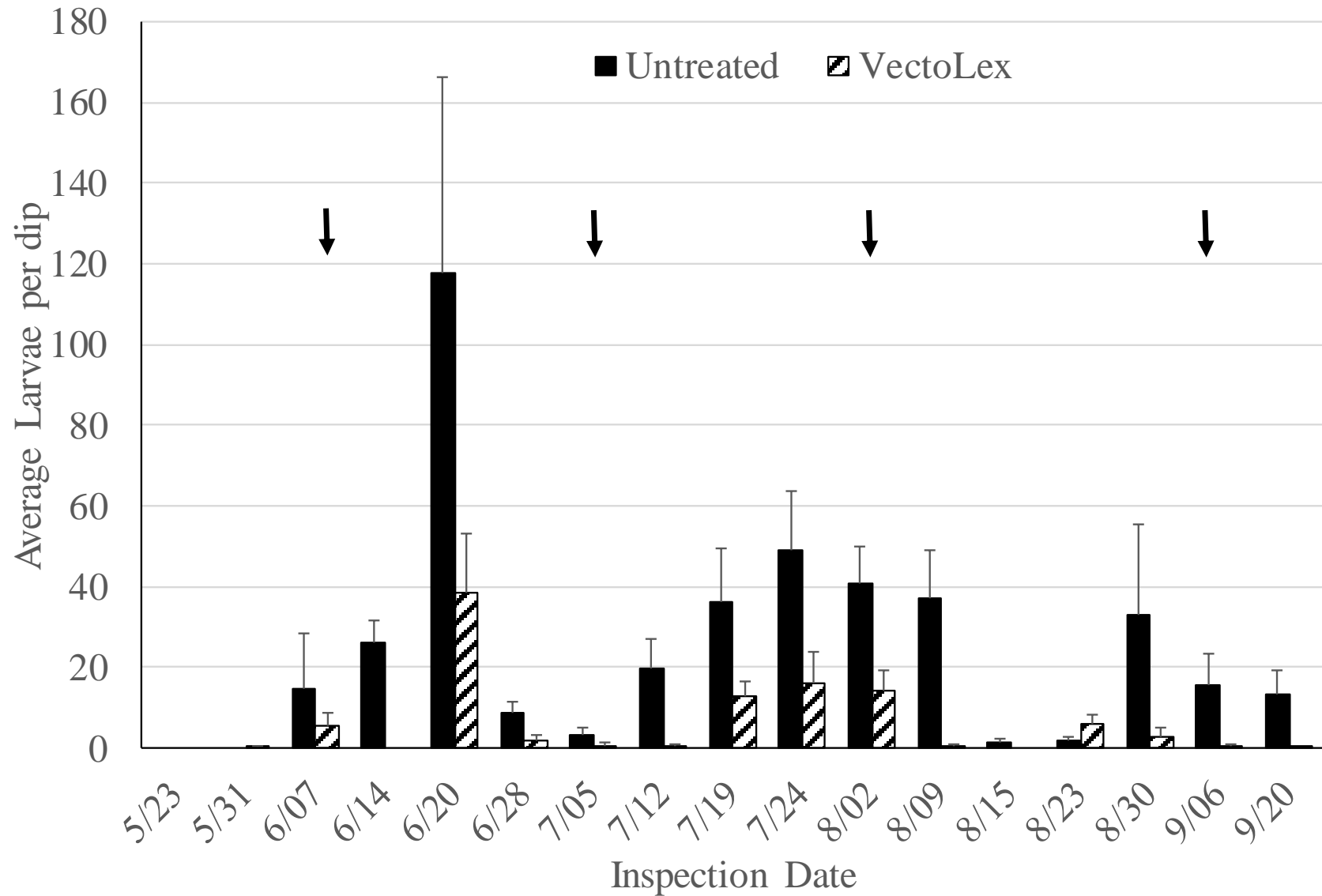
2019 VectoLex® Test

- Goal of 2019 test was to evaluate effectiveness of VectoLex® FG in catch basins
- Surveyed ten catch basins treated monthly with 20 g/cb and 12 untreated catch basins
- Effectiveness evaluated using larval dips (instars determined)
- Also evaluated effectiveness using a pass/fail system developed by Harbison, Nasci and Clifton to determine when to retreat
 - Harbison, J. E., Nasci, R. S. and Clifton, M. 2019. Operational Quality Control for Catch Basin Larviciding at the North Shore MAD. Wing Beats. 30: 5-13. Summer 2019

2019

VectoLex[®] FG (20 g/cb) effectively controlled mosquito larvae in catch basins

Arrows =
Treatment
dates



2019

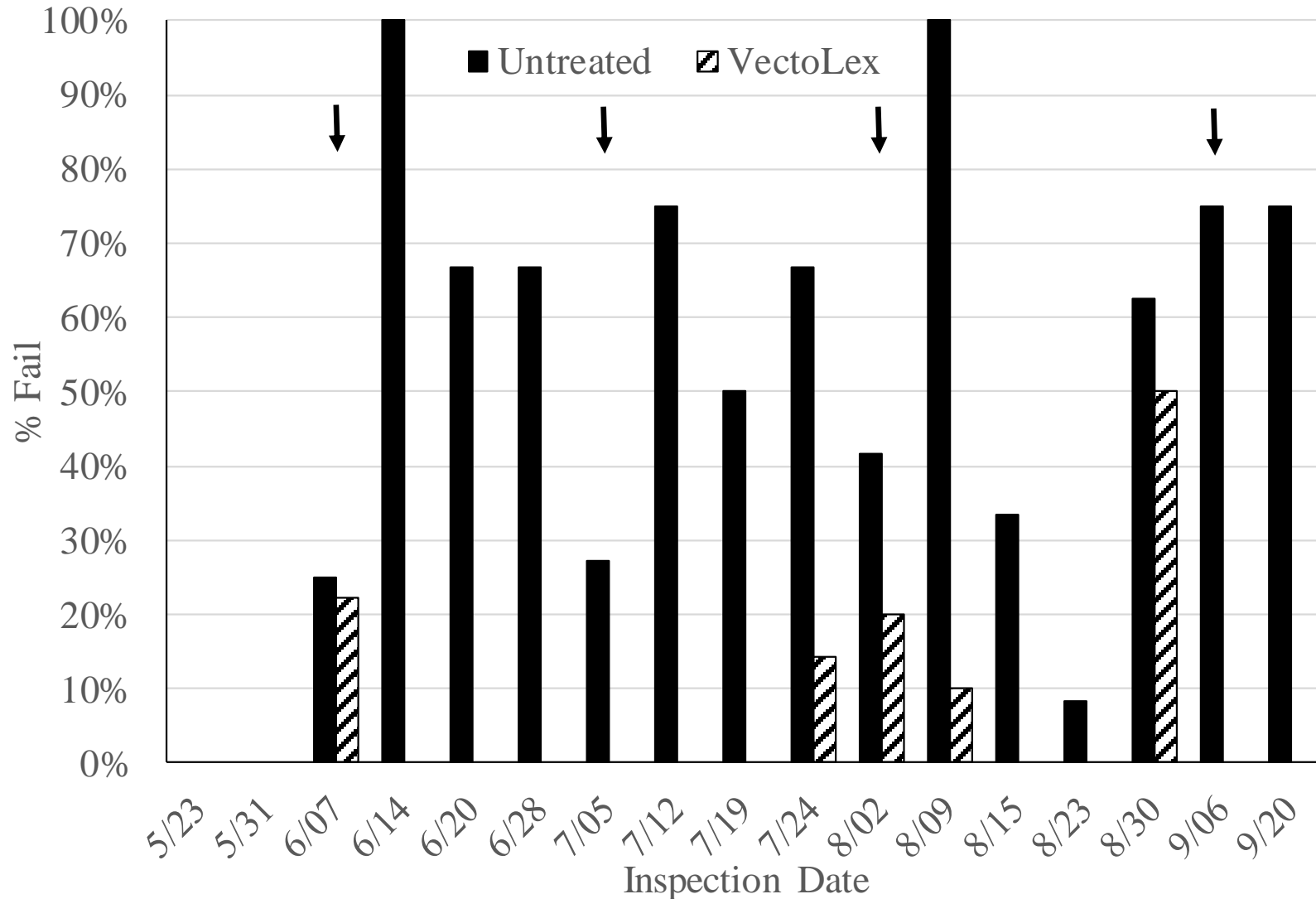
VectoLex[®] FG (20 g/cb) effectively controlled mosquito larvae in catch basins

	% CBs Fail/Week	Number of Weeks Fail	
	Mean (\pm SE)	<25% CBs Fail	\geq 25% CBs Fail
Untreated	51.4% (\pm 7.7%)	3	14
VectoLex[®] FG	6.9% (\pm 3.3%)	16	1

2019

VectoLex[®] FG (20 g/cb) effectively controlled mosquito larvae in catch basins

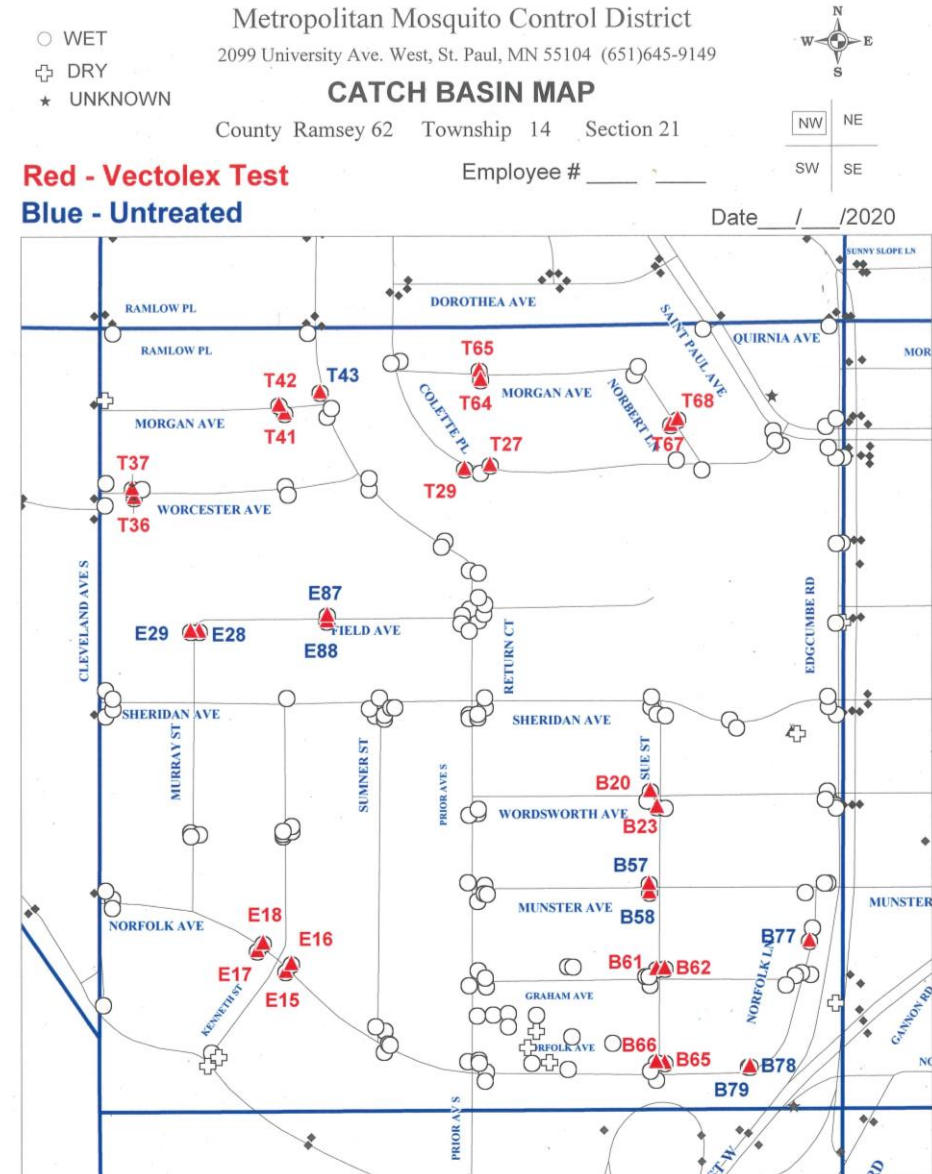
Arrows =
Treatment
dates



Fail = one or more 3rd, 4th instar larvae or pupae in sample

2020 VectoLex[®] Test

- Expanded evaluation of 20 g/cb rate
 - 60 catch basins treated monthly and 30 untreated catch basins
- Effectiveness evaluated using larval and pupal counts
- Evaluated ability to use VectoLex operationally by bicycle



2020 VectoLex[®] Test

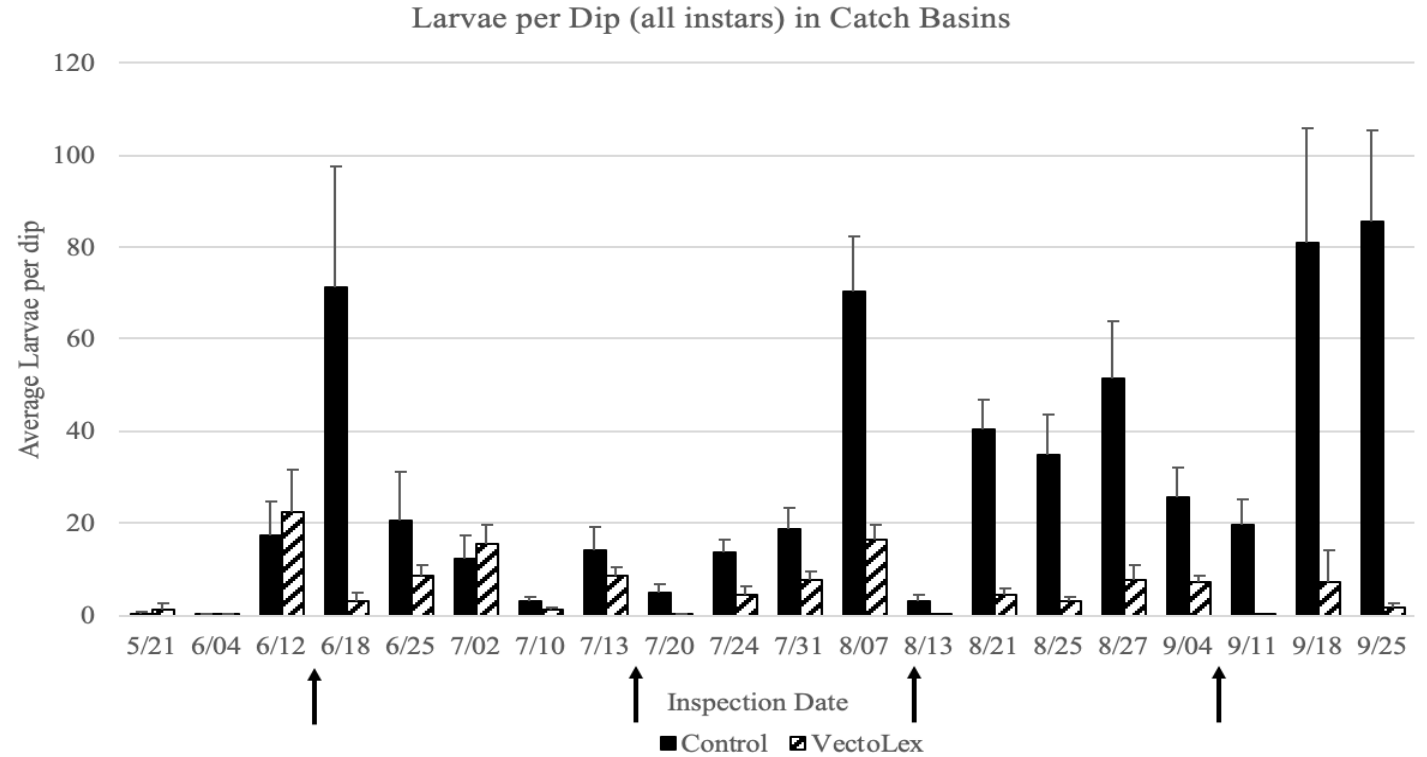
- Weekly surveillance
 - Two dips from each CB
 - Recorded dip counts (larvae & pupae)
 - Collected representative sample for species & instar identification
- First treatment after larvae found in at least ½ of catch basins (June 15)



2020

VectoLex[®] FG (20 g/cb) effectively controlled mosquito larvae in catch basins

Material	No. Inspections	Larvae per dip	
		Mean	SE
VectoLex [®] FG	1,053	6.14	1.37
Control	523	29.49	6.24

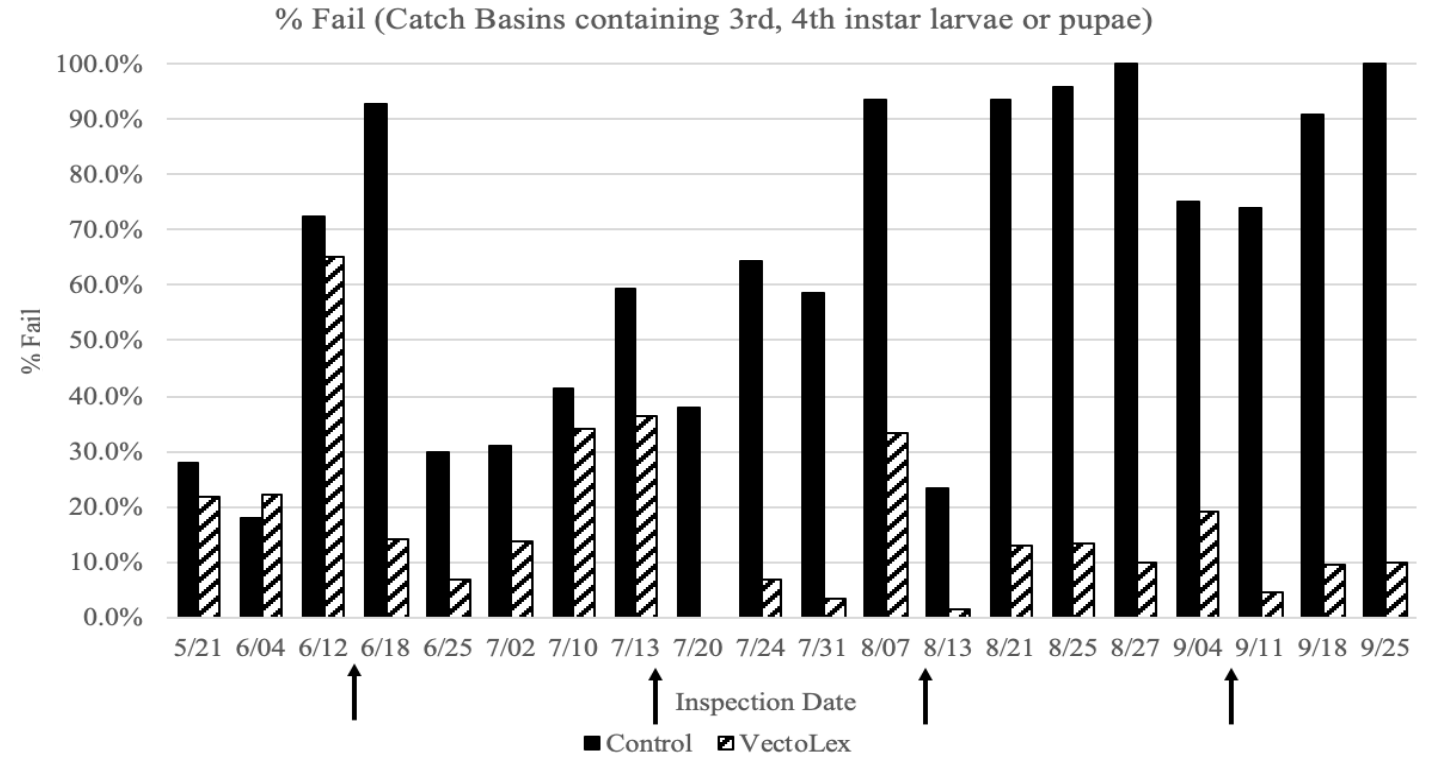


Arrows = Treatment dates

2020

VectoLex[®] FG (20 g/cb) Harbison/Nasci pass/fail evaluation

Material	% CB Fail/Week	# Weeks	
		< 25% Fail	>25% Fail
VectoLex [®] FG	13.5%	14	3
Control	68.3%	1	16



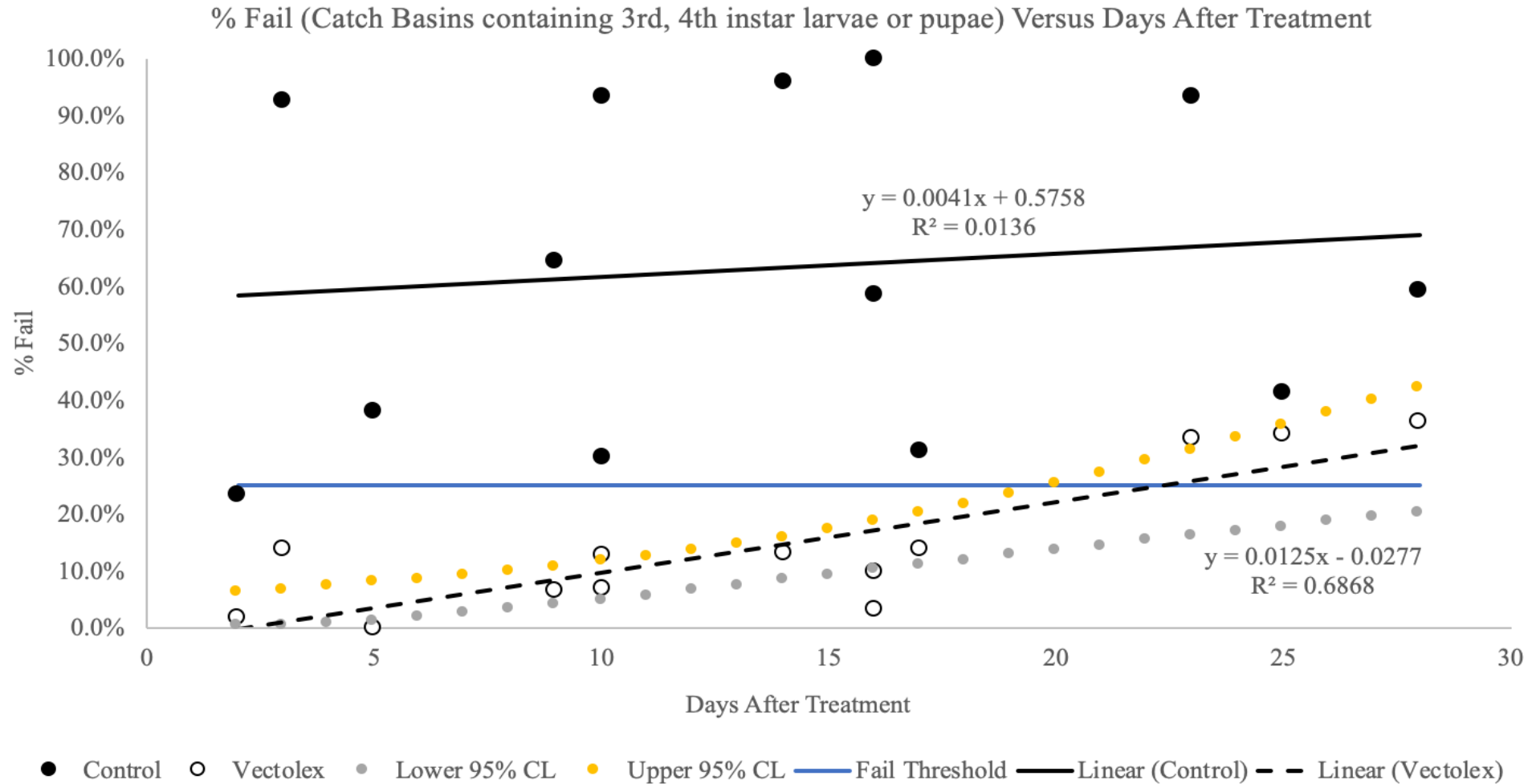
Arrows = Treatment dates



Fail = one or more 3rd, 4th instar larvae or pupae in sample

2020

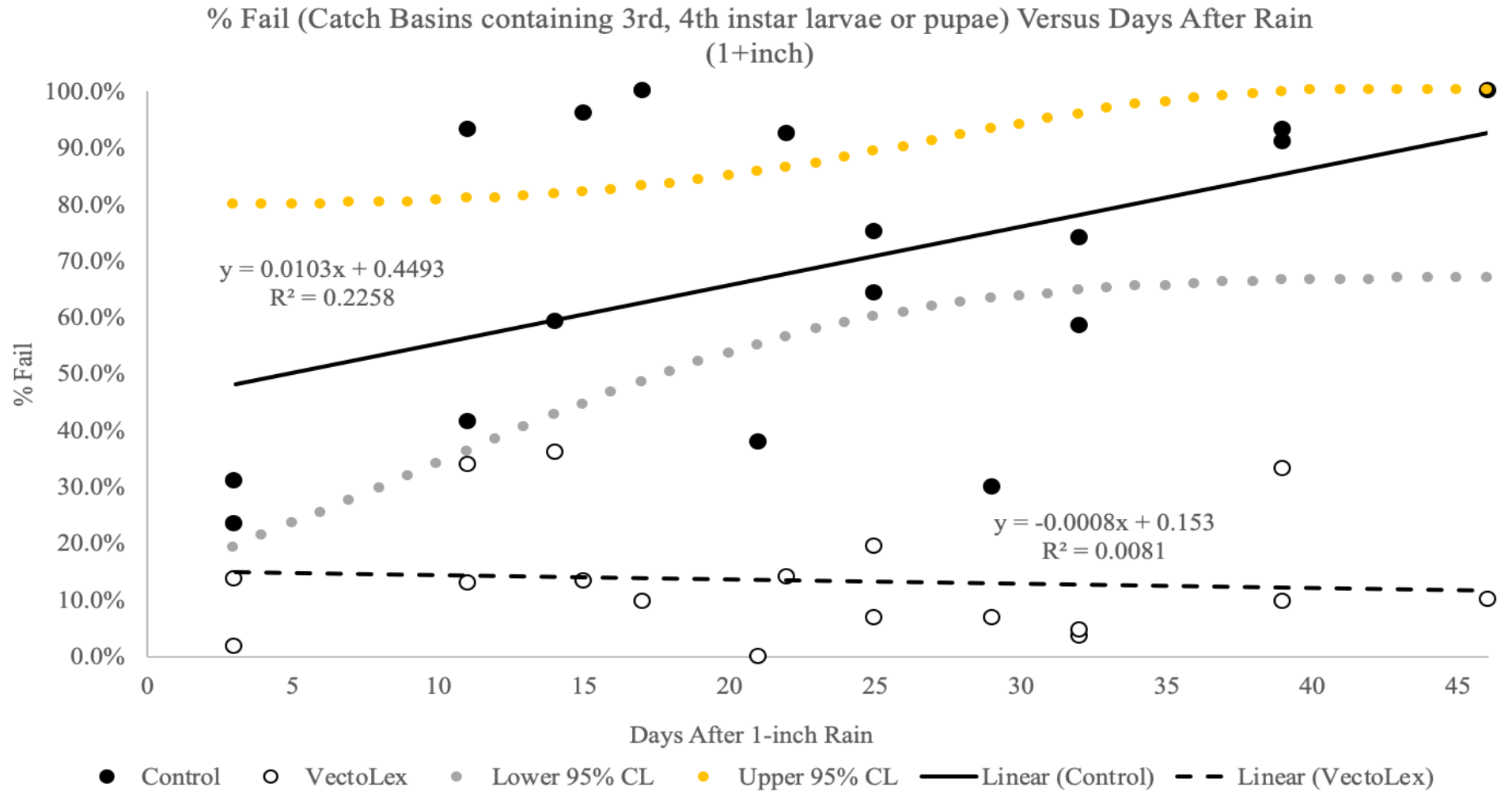
VectoLex[®] FG (20 g/cb) Harbison/Nasci pass/fail evaluation



Fail = one or more 3rd, 4th instar larvae or pupae in sample

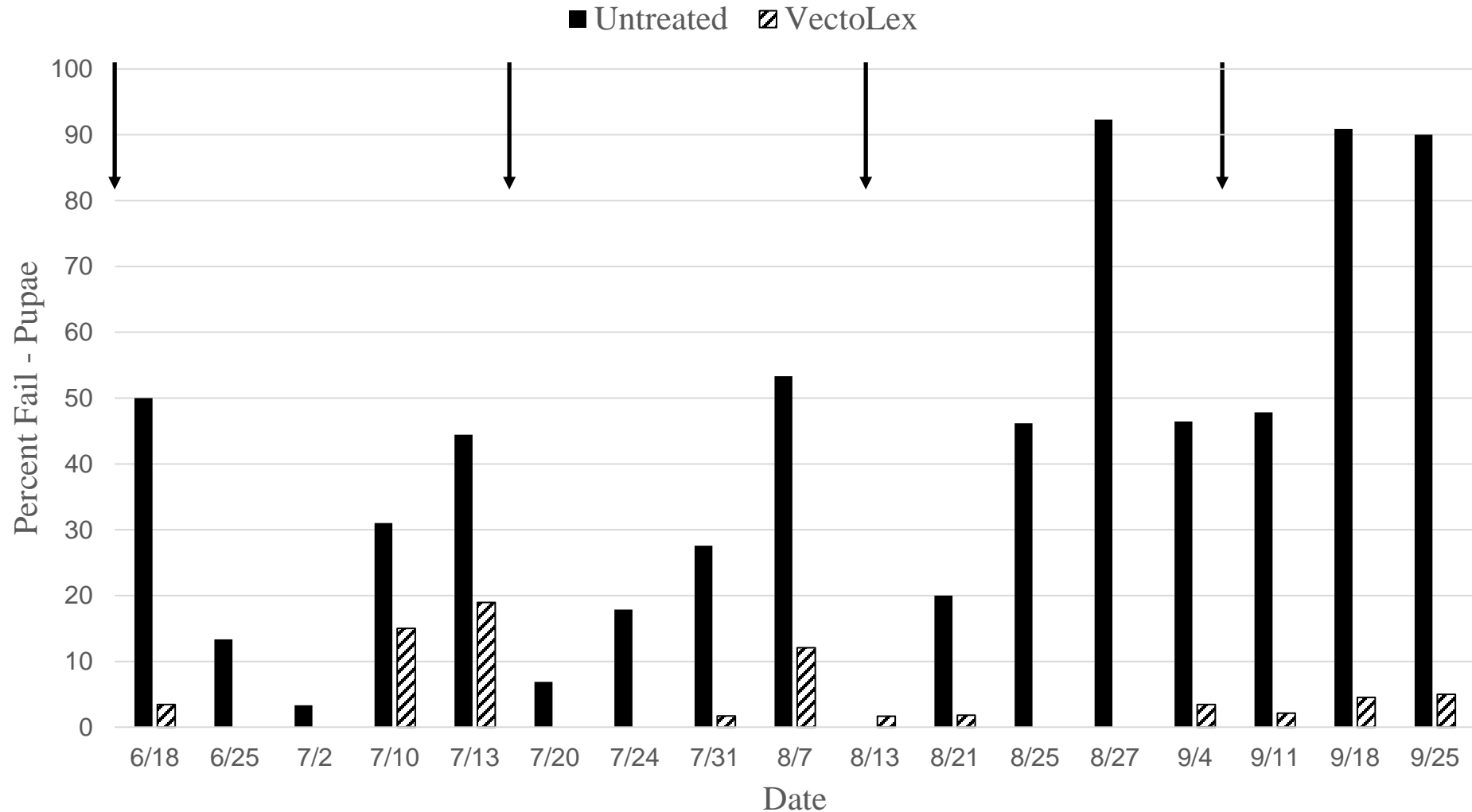
2020

VectoLex[®] FG (20 g/cb) Harbison/Nasci pass/fail evaluation



2020

VectoLex[®] FG (20 g/cb) Harbison/Nasci pass/fail evaluation (pupae only)



Fail = one or more pupae in sample

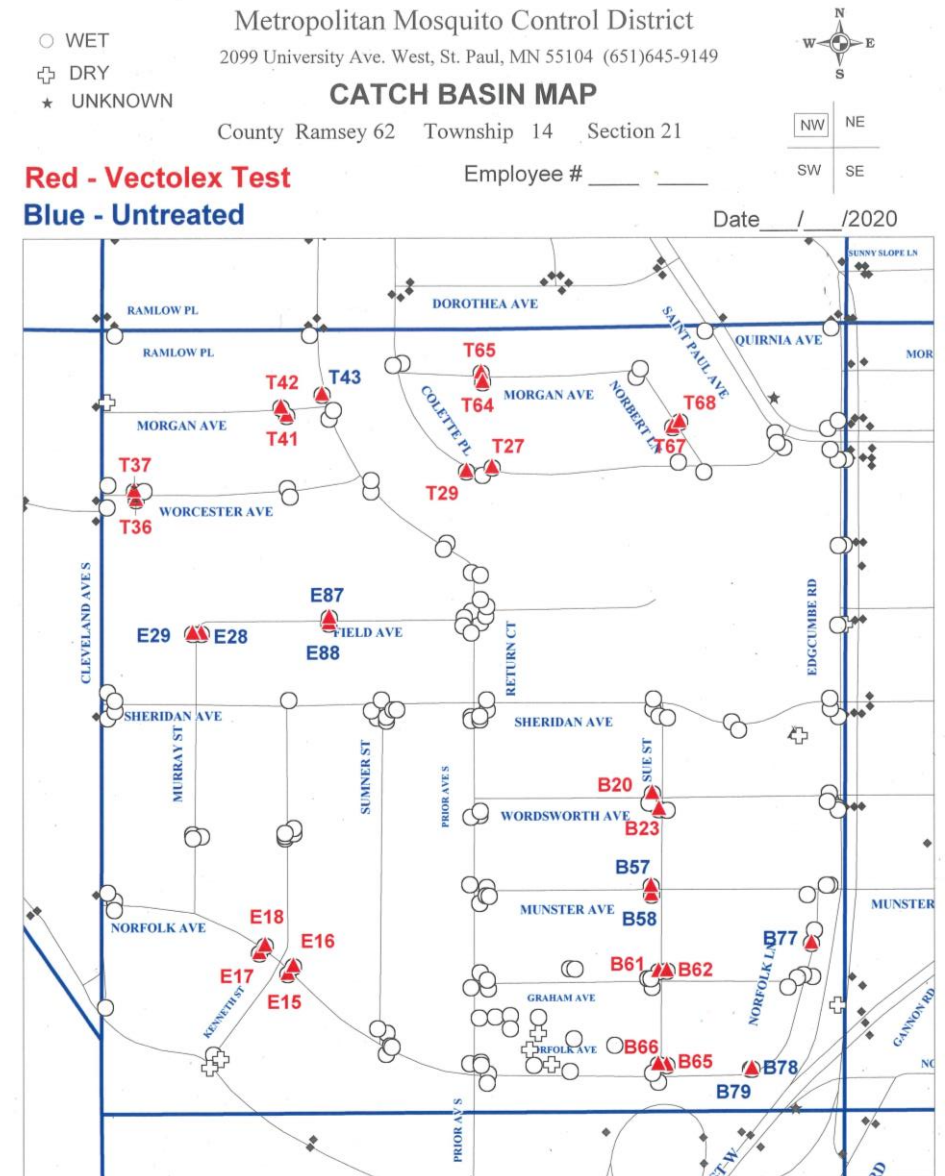
2020

VectoLex[®] FG (20 g/cb) effectively reduced pupae in catch basins

Material	No. Inspections	Pupae per dip		# Weeks		% CB Fail/Week	
		Mean	SE*	< 25% Fail	> 25% Fail	Mean	Range
VectoLex[®] FG	1,053	0.06	0.02	17	0	4.1%	0 – 19%
Control	523	2.89	1.07	6	11	40.1%	0 – 92%

Operational use of VectoLex[®] FG

- Treatments by bike are more challenging than by truck
- Test areas with 150+ CBs to treat
 - Needed 7 to 7.5 pounds to complete map
- Bike basket could hold over 12 pounds
 - Typically carry less than 3 pounds pellets



Operational use of VectoLex[®] FG

- Found 30ml serving scoop to measure 20 grams VectoLex
 - 1,713 treatments
 - Operational season average 19.2 grams
- To work VectoLex into operation
 - Devise a strategy that is feasible – treat a percentage of CBs, rotate with Methoprene, use only for one round of treatments per year, test lower doses???



Unmanned Aircraft Systems Update 2020

Scott Larson

Assistant Entomologist

Drones in Mosquito Control

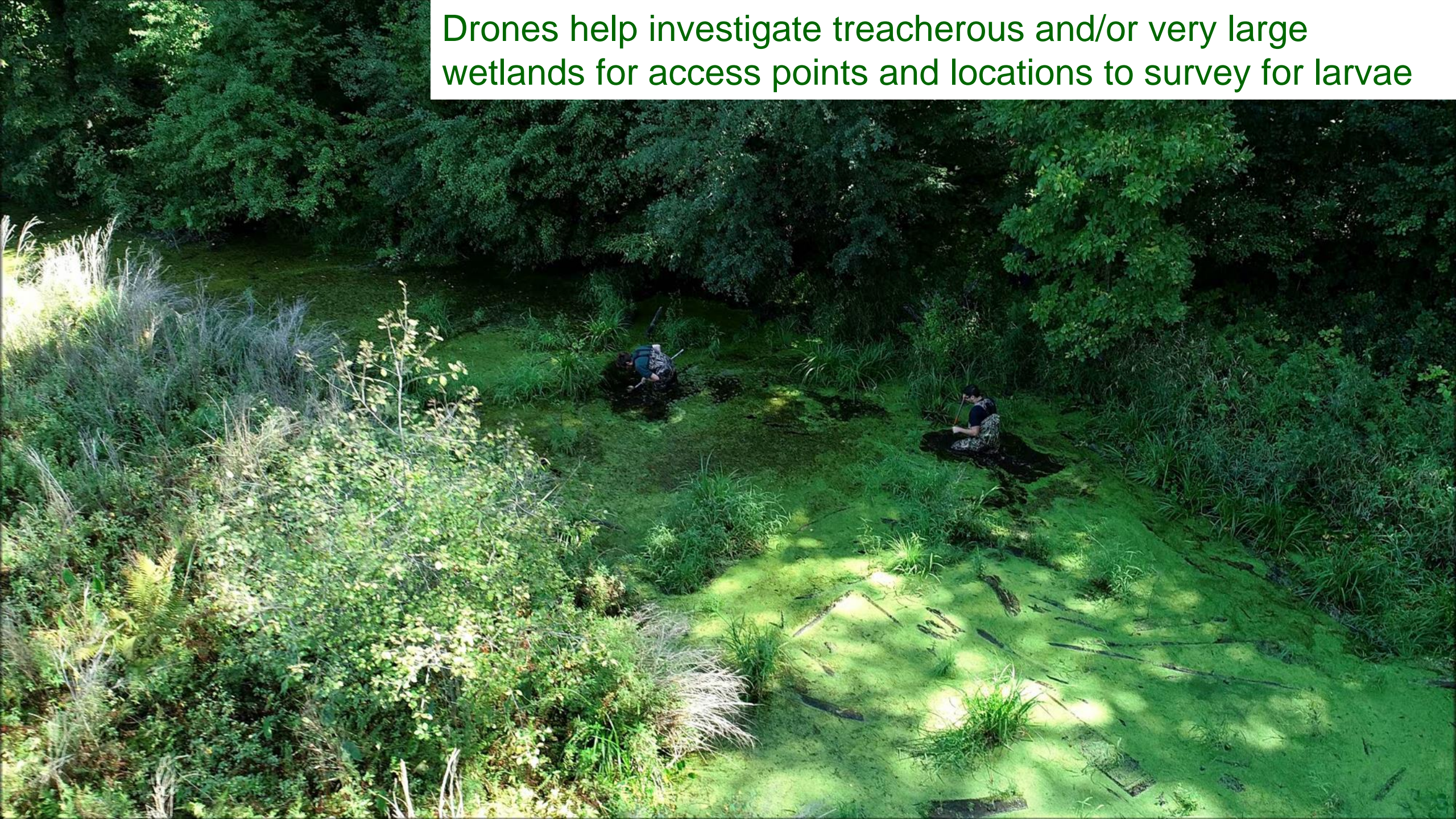
- Scout for breeding sites
- Apply insecticides



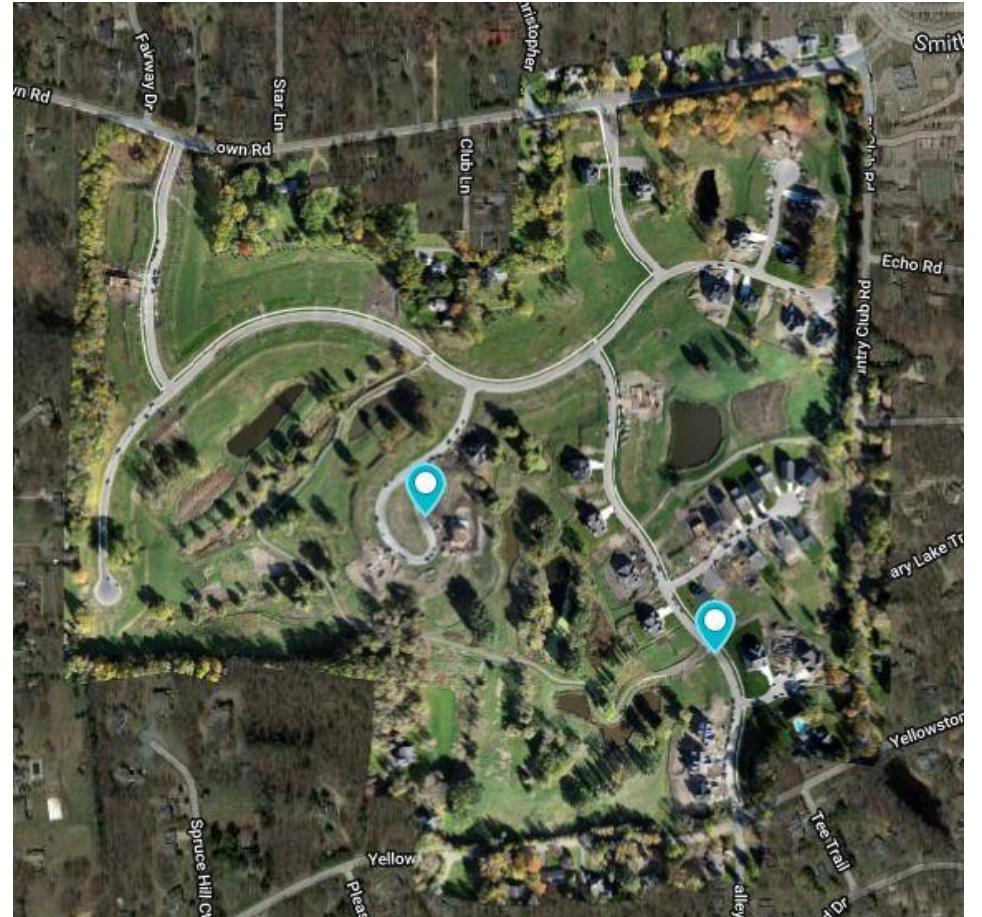
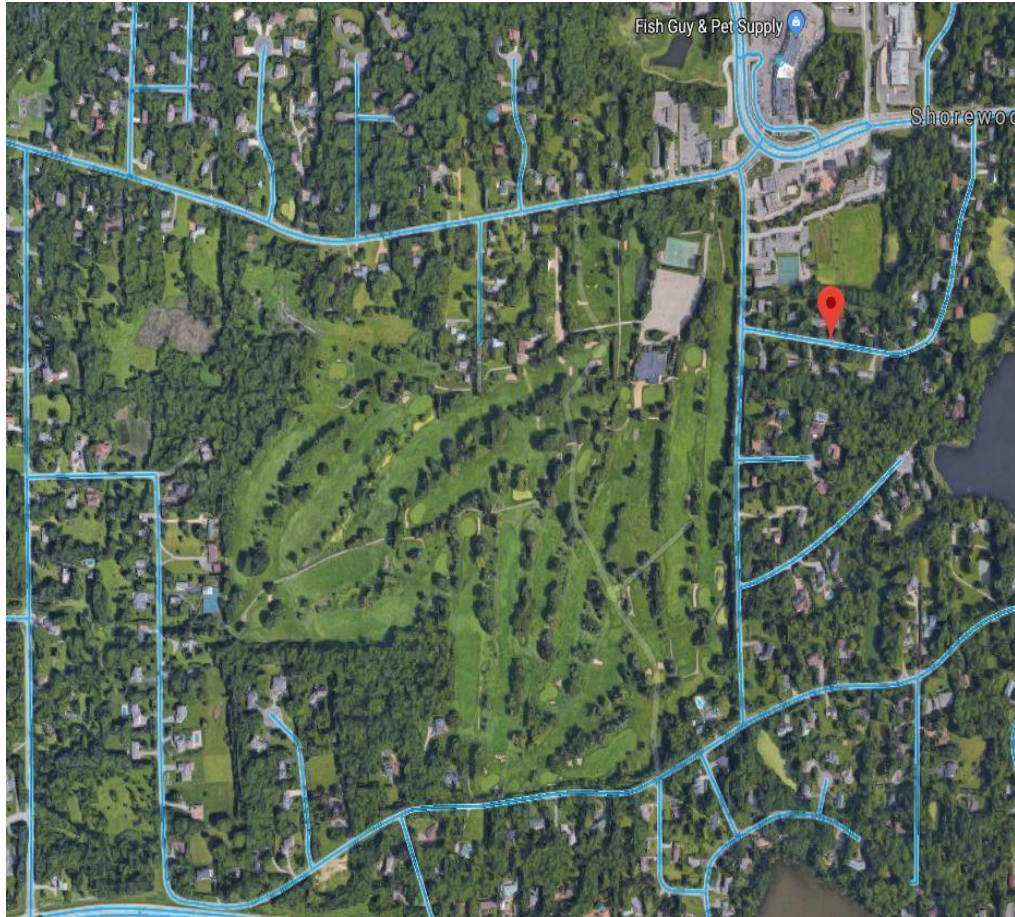
Examples of Drone Use



Drones help investigate treacherous and/or very large wetlands for access points and locations to survey for larvae



Update Map Imagery After Construction



Another Example of Updated Imagery

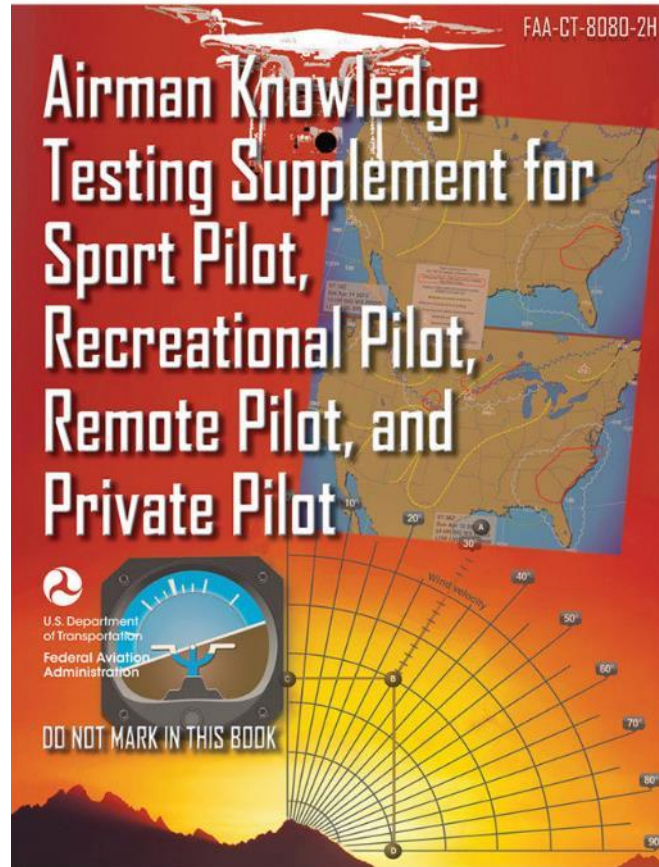
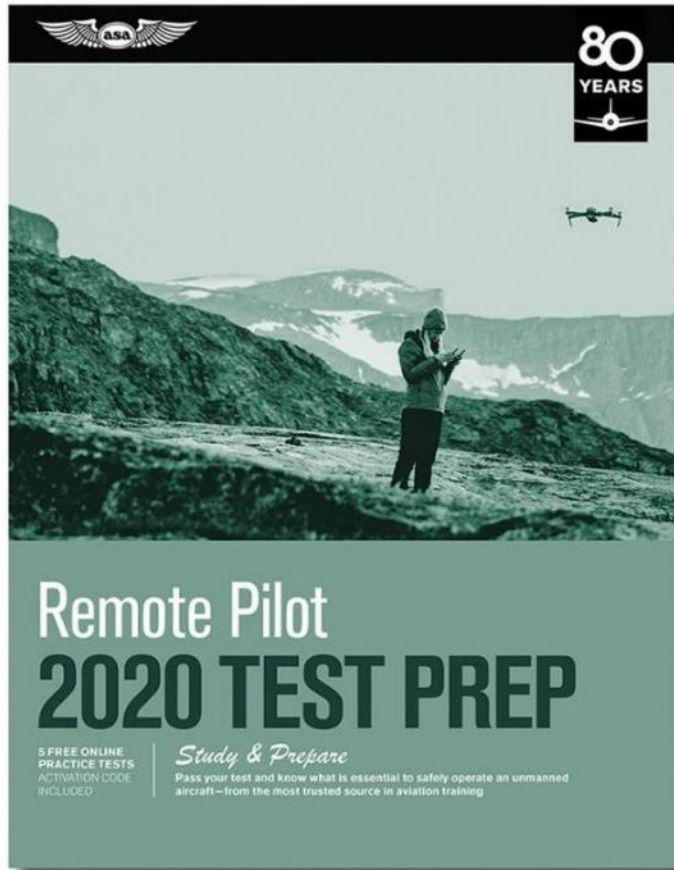


Drone Group at MMCD

- Formed in mid-2018
- 21 members meet regularly
- Evaluate various uses for drones in the field/ practice operating drones
- Currently, 11 members have passed their Part 107 Drone Pilot Test
- In-house training to pass tests



Training at MMCD for Part 107 (Pilot)





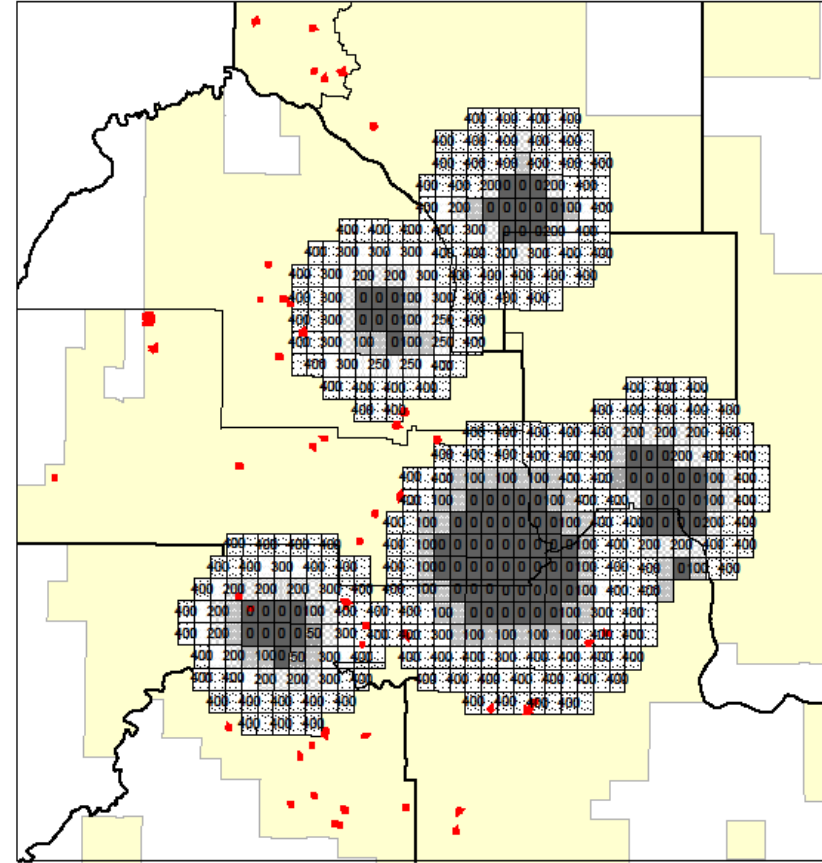
Certificates of Waiver or Authorization (COA)

- FAA approved (Jan 6th, 2020)
- Pilots must have their aerial applicator license (Category B)
- Allows for MMCD to treat sites via drones
- Currently, we must issue a NOTAM (Notice to Airmen) 24-72 hours before treatment



Restrictions for Treatments at MMCD

- Remote pilot license (Part 107, self-imposed)
- Aerial applicator license (Category B)
- In appropriate airspace below height restrictions
- Must issue NOTAM before treatment (for now)
- Avoid hazards (powerlines, etc.)
- Keep distance from known bird nests and protected species
- Cannot fly above people or at night (*for now...*)
- Monthly reporting to FAA



Incident – drone recovered from tree

September 16th 9:50AM

A “loss-of-link” occurred between the controller and the drone
Emergency procedures implemented (return-to-home activated)

Drone did not ascend to appropriate height, stuck in tree

Recovered from tree

We repaired the rotors, 1 GPS receiver, and the outer shell

Incident reported to FAA – no follow-up requested

Learned a lot and altered procedures to avoid future accidents

2020 – First Year Treating by Drone

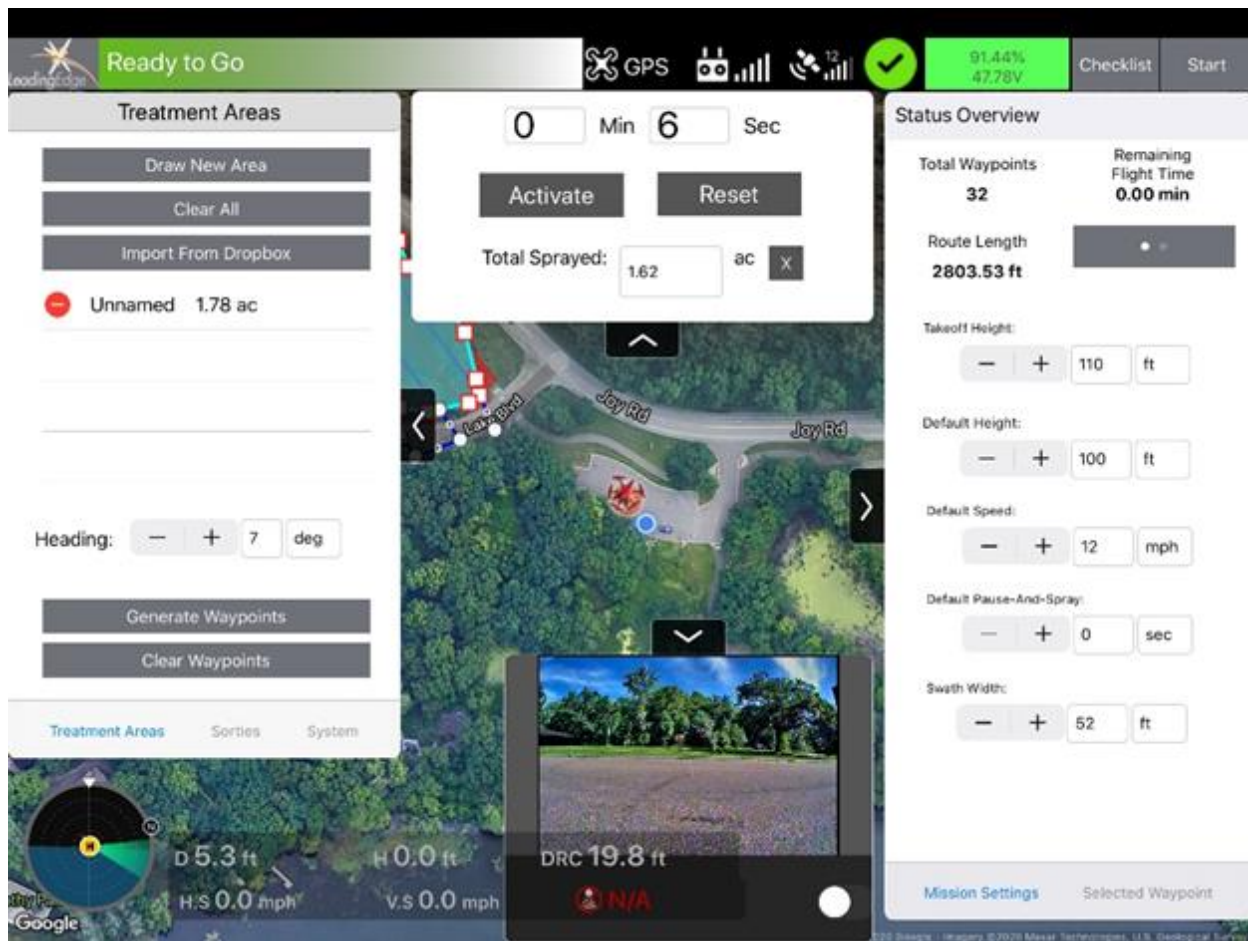


Larvicide Treatments in 2020

Leading Edge (PrecisionVision 22)



Software and Trailer



Calibration



Treatment Evaluations: Pan Placement



2020 Drone Treatments

Tested for ground treatments and *Cq. perturbans* control

34 sites (48.19 acres) were treated with Altosid® P35

29 sites (39.5 acres) were treated with VectoLex® (~600lbs)

- Replaced ~12,000 briquets
- Significant cost savings



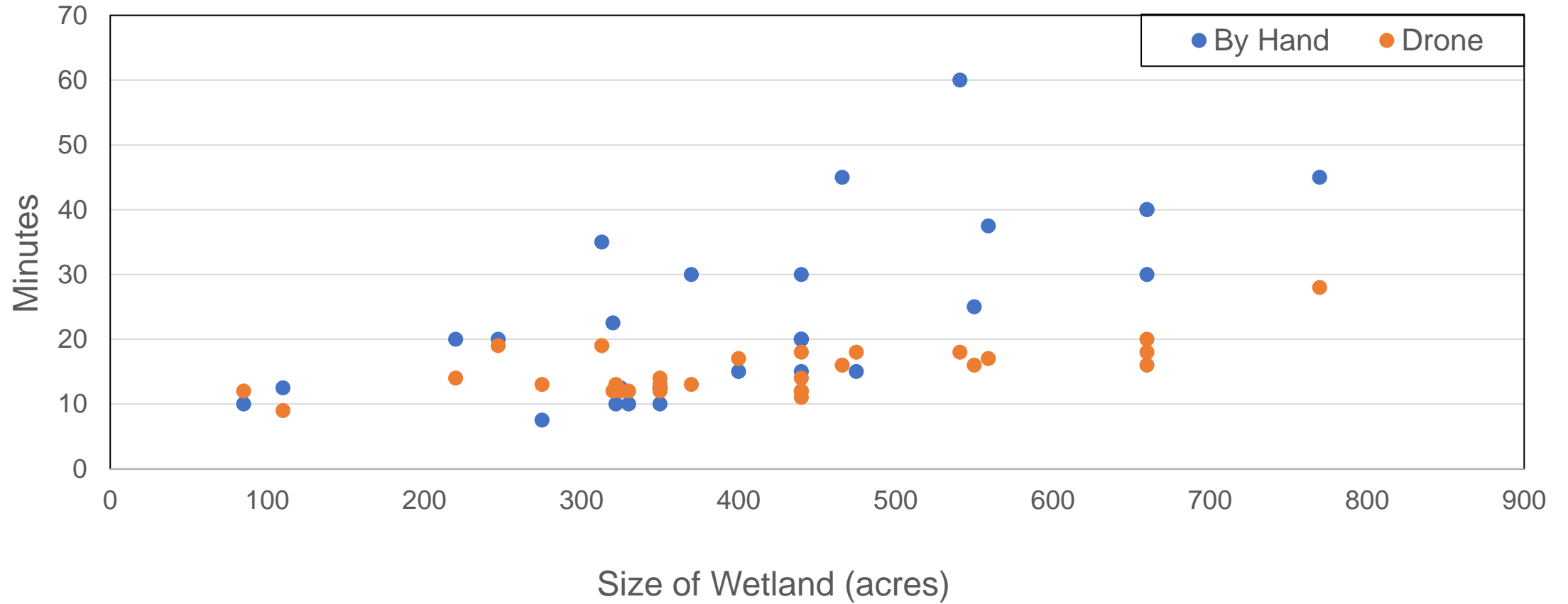
Treatment Efficiency

- Average treatment time to fly cattail sites was ~17.1 minutes
- Average time to deploy briquets at these sites was ~47.1 minutes
- Note that two people (at a minimum) are needed for drone treatments



Treatment Efficiency

Treatment Times vs. Wetlands Acres



UAS SOP

- Safety
- Privacy and data management
- Pilot and crew training
- Basic operations
- Emergency operations



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UAS SOP

- Thanks to Grand Forks Mosquito Control Organization and Grand Forks Public Health Department for allowing us to base our SOP on their previously created document

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Future Uses of Drones at MMCD (2021+)

- Quicker scouting for breeding sites/ treat difficult to reach sites
- Update maps with current aerial imagery
 - Especially in areas of new construction
- Treat small aerial sites that are difficult to treat via helicopters and replace briquets at appropriate cattail sites
- Consider emergence cage tests of ground sites treated with VectoLex and Altosid by drone to verify effective control

Questions?

