FY 2021-2022 Annual Operations Report

EAST FLAGLER MOSQUITO CONTROL DISTRICT

1952-2022 70TH ANNIVERSARY

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Daily mosquito traps have shown a steady low-level influx of two species of flood water mosquitoes Aedes infirmatus and Psorophora ferox over the past few weeks (Chart below). The typical surge in mosquito populations following heavy rains has not occurred for the month of July. The unusual lack of a surge in population of flood water mosquitoes migrating into populated areas may be the result of scattered showers followed by high heat effectively limiting the ability of these species to reproduce by reducing the length of time standing water remains.	47
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The main factor for the difference in prevalence among floodwater and permanent water mosquito types appears to be that the high heat during the summer prevented flood water from remaining long enough to permit a breeding cycle to occur, whereas enough rain was received to maintain standing water without drying down. Drying down permanently wet areas is a higher bar to clear because the water is deeper in these areas and is less prone to percolation by being closer to the water table.	74
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Operations Overview

The start of the fiscal year in October saw low mosquito activity with some permanent-water areas drying-down and some cooler temperatures. Spraying resumed the first week of November with a warm spell. Mosquito activity was low through the winter months. In subtropical Florida we monitor year-round for mosquito activity and can conduct control missions at any time as needed.

Warm weather and mosquito activity resumed by mid-April. April also saw the highest mosquito activity for the fiscal year. By May *Coquillettidia perturbans* had started emerging from the cattail swamps and persisted to as late as August. This species is prevalent from Spring through Summer throughout Florida, but typically recedes in the District by late Spring with repeated control measures. Early May is also when we begin larvicide pretreatments in the saltmarsh. Mosquito activity tapered off by the end of May and was at low levels through mid-July.

A lack of precipitation and high heat sustained a low level of mosquito activity since the end of May until the week of July 11. That week saw a substantial presence of flood water species after seven weeks of low mosquito activity. On July 18 the Florida Department of Health issued a mosquito-borne illness alert for local transmission of Dengue in Miami.

Limited rainfall and high heat limited mosquito production overall since early August until the week of September 5. That week saw moderate mosquito activity after four weeks of low mosquito activity, with a notable increase in *Culex quinquefasciatus*. Hurricane Ian passed over Flagler County on September 28.

More detail is available in the weekly operations updates. These weekly reports on operations are prepared from April through October and attached to this report. Highlighted sections have been bookmarked and can be accessed directly through the link in the table of contents. Mosquito activity varies from week to week throughout the season and no two seasons are the same. It is our hope that reading the details of each week will provide context to mosquito control operations.

Accomplishments and Milestones

Turning 70…

The East Flagler Mosquito Control District was established in 1952. To mark 70 years of service to the community we made an addition the Palm Cost Arts Foundation's Turtle Trail. This work of art commemorates the mosquito control efforts over the past 70 years and honors our long serving Commissioner Julius "Jules" Kwiatkowski, with the turtle being named Jules. You can see him on the turtle-trail.

Revised 2003 Agreement with Flagler County

In response to the public's request for mosquito control in western parts of the County and the need to fund such services, the Board of County Commissioners adopted County Resolution 2002-31 on February 28, 2002, that established a Special Assessment for mosquito control procedures in the Espanola and Rima Ridge areas. On April 21, 2003, the Flagler County Board of Commissioners agreed to contract services for these new areas known as the West Flagler Mosquito Control District (WFMCD). The fees for Rima Ridge and Espanola are $11.76 and $14.62 a year

respectively, with total revenues of $1,350 and $2,300 respectively. The same scenario exists in the Western portions of Volusia County, where spraying is by cooperative agreement.

In 2022, a revised agreement between the East Flagler Mosquito Control District and Flagler County Emergency Management allowed for the purchase of a mosquito trap equipped technology to autonomously count mosquitoes using a process similar to facial recognition. This allowed a considerable cost savings on surveillance. Previously no surveillance was conducted outside the District due to the expense of sending personnel to remote areas of the County to collect traps daily for processing. Unlike the more traditional surveillance conducted by mosquito control programs that tracks the number and species of each mosquito trapped daily to form the basis of mosquito control operations, these autonomous traps are not capable of identifying the mosquito species, and therefore cannot be used for justification of pesticide application as required by state and federal law. However, the autonomous mosquito traps allow for an early indication of above average mosquito activity.

The revised agreement also allows for Flagler County residents in all areas outside the East Flagler Mosquito Control District to call or report via an online portal issues they are having with mosquitoes. This information can then be used to gain the County's authorization to spray for mosquitoes in areas outside the District.

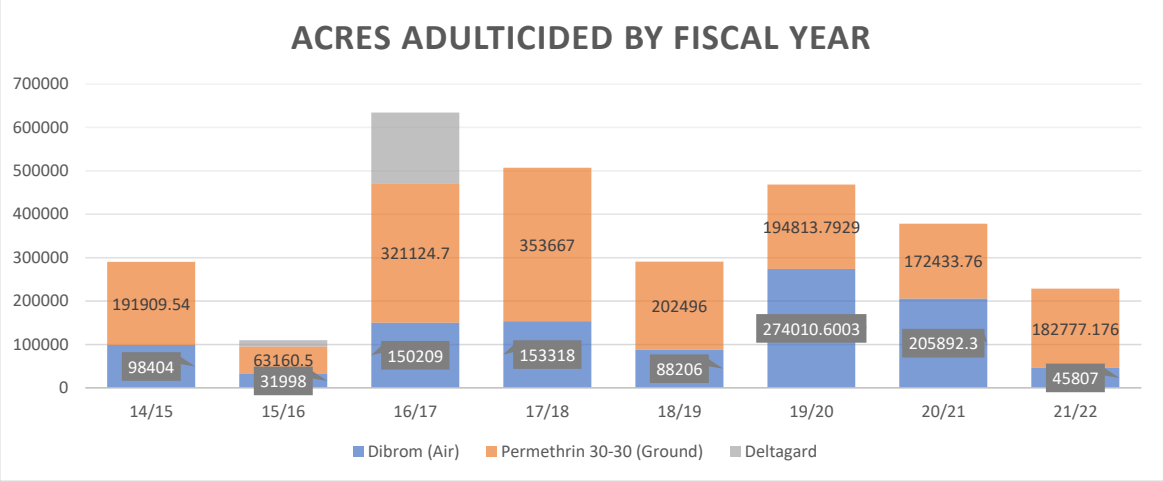
Enhanced Surveillance

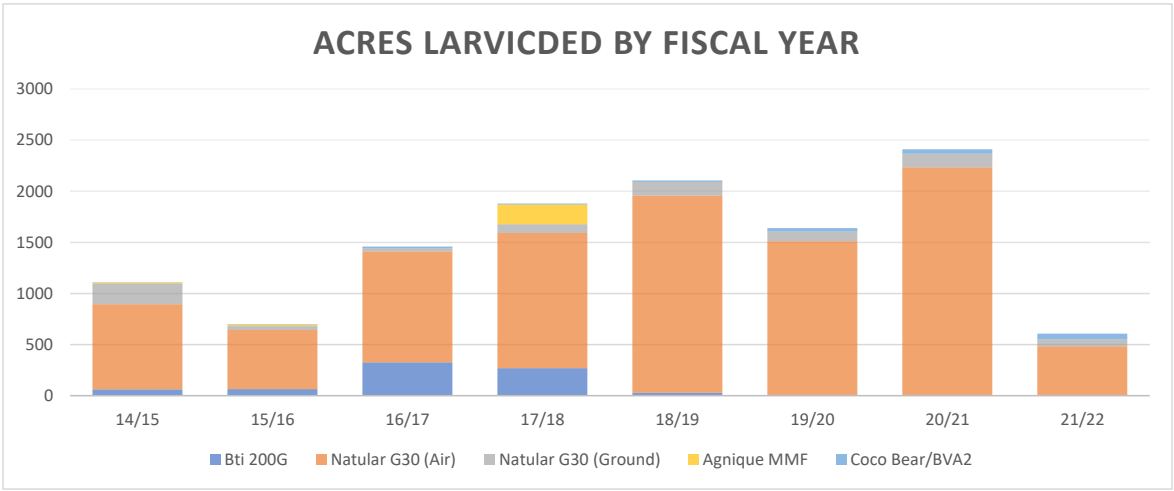
The District has been working on cost effective ways to monitor mosquito development in the saltmarsh. We can control mosquitoes in the saltmarsh by interrupting their life cycle while they are still in the water. To do this we apply organically certified (OMRI Listed) bacterially derived compounds at intervals throughout the season.

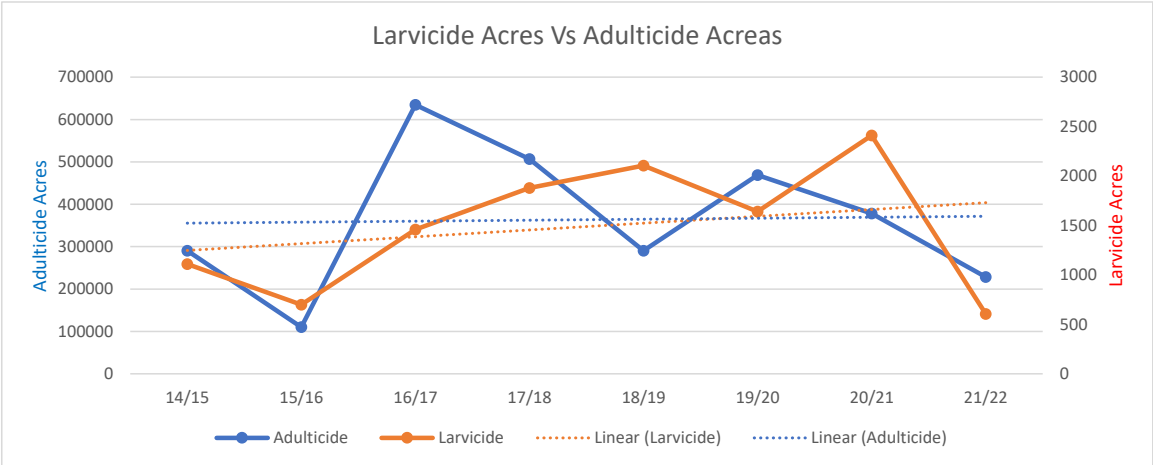
Timing of applications is critical and is based on the drying trend of temporarily flooded areas in and around saltmarsh habitats. To make the best use of limited staff, the District has implemented remote monitoring in these areas though the use of cameras, soil moisture probes, and pressure transducers to monitor water levels in key areas. This allows us to prioritize which sites are surveyed and treated for the optimal treatment timing.

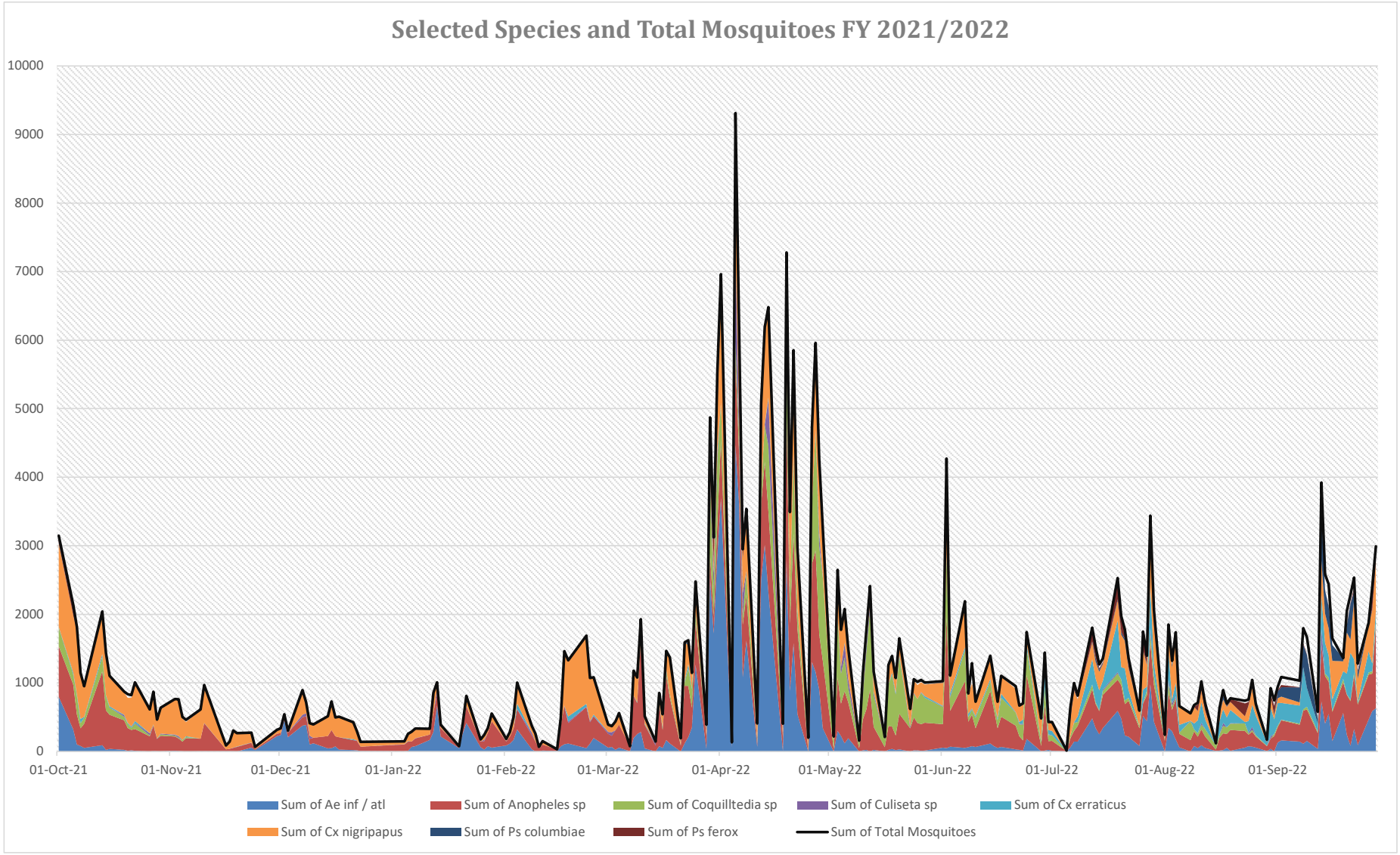
The first probes and cameras were purchased last fiscal year, FY 2020-2021. In FY 2021-2022 we added a pressure transducer to monitor the tide and its influence on the saltmarsh. Using both types of equipment, we were able to see as well as accurately measure and record the impacts of Hurricane Ian. While this technology is not new, we are applying it innovatively for mosquito control purposes. You can see how this technology is helping the District better control mosquitoes in the saltmarsh by reading this operations supplemental.

Pesticide Usage by Fiscal Year



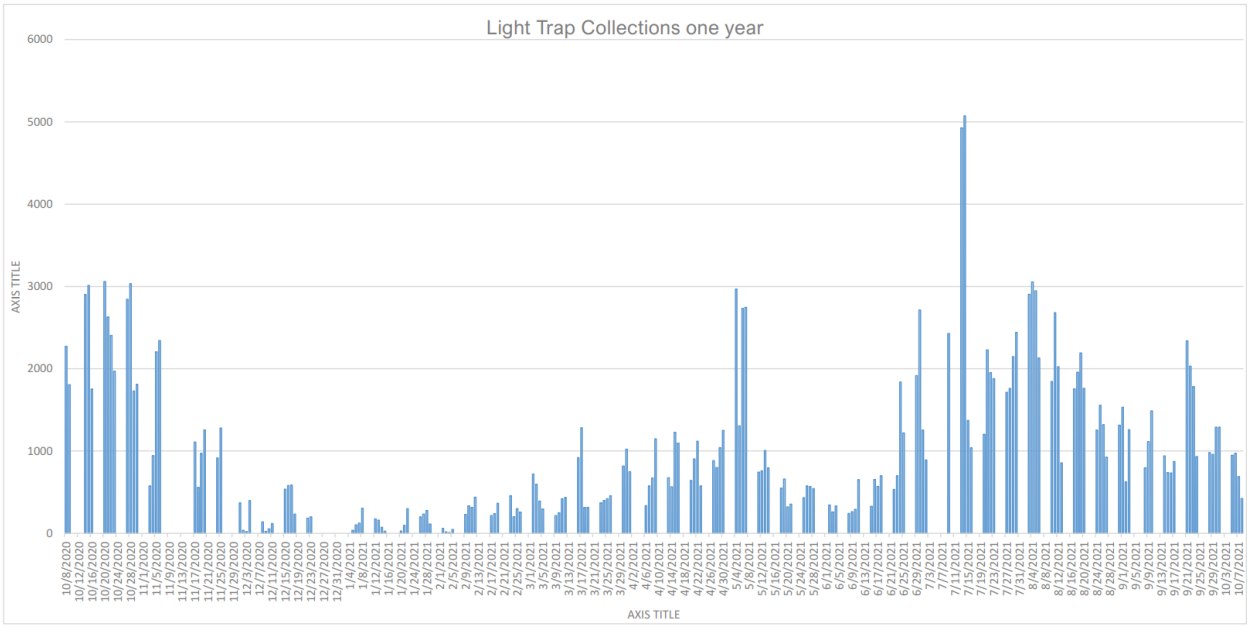




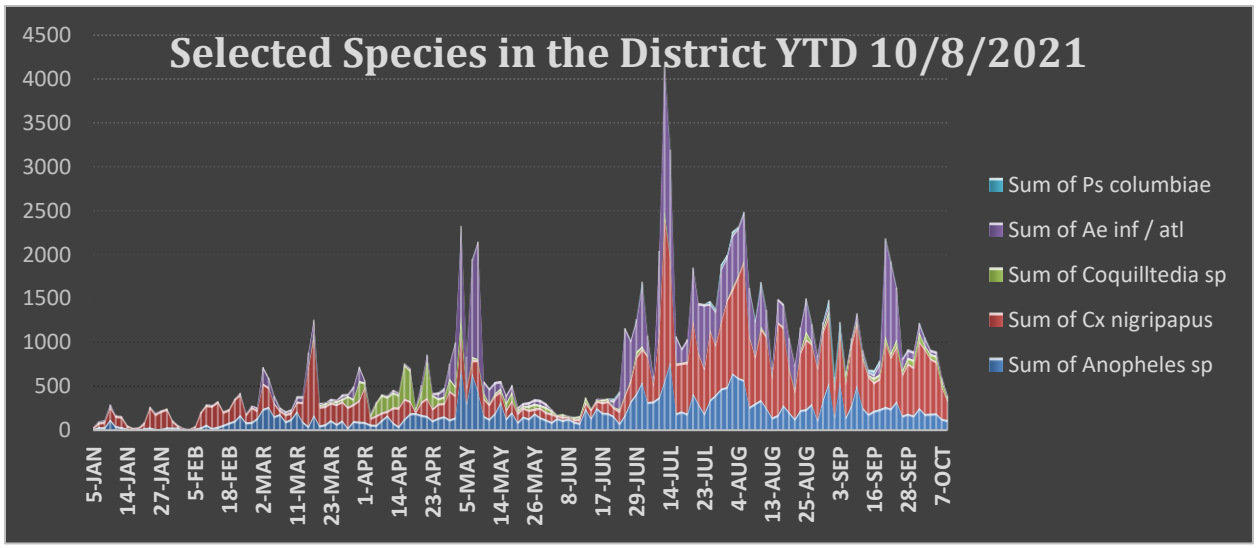

Selected Species and Total Mosquitoes FY 2021/2022
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
01-Oct-21
01-Nov-21
01-Dec-21
01-Jan-22
01-Feb-22
01-Mar-22
01-Apr-22
01-May-22
01-Jun-22
01-Jul-22
01-Aug-22
01-Sep-22
Sum of Ae inf / atl
Sum of Anopheles sp
Sum of Coquilltedia sp
Sum of Culiseta sp
Sum of Cx erraticus
Sum of Cx nigripapus
Sum of Ps columbiae
Sum of Ps ferox
Sum of Total Mosquitoes

Week of 10/04/2021 Operations Update

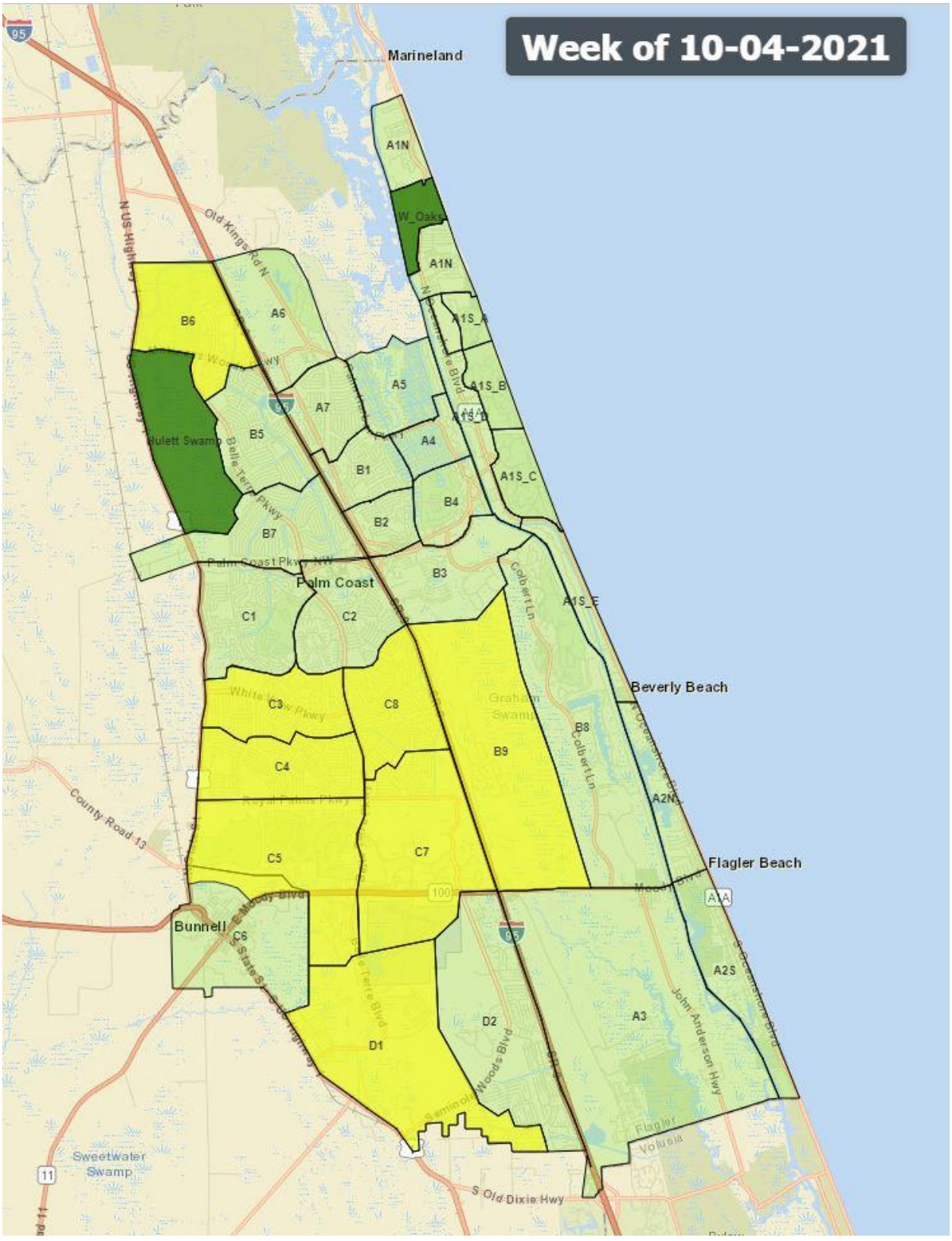
The *Culex nigripalpus* population was the main issue this week. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Anopheles species dipped to baseline levels of population and *Culex nigripalpus* drastically declined by the end of the week with treatments in select zones (graph below).

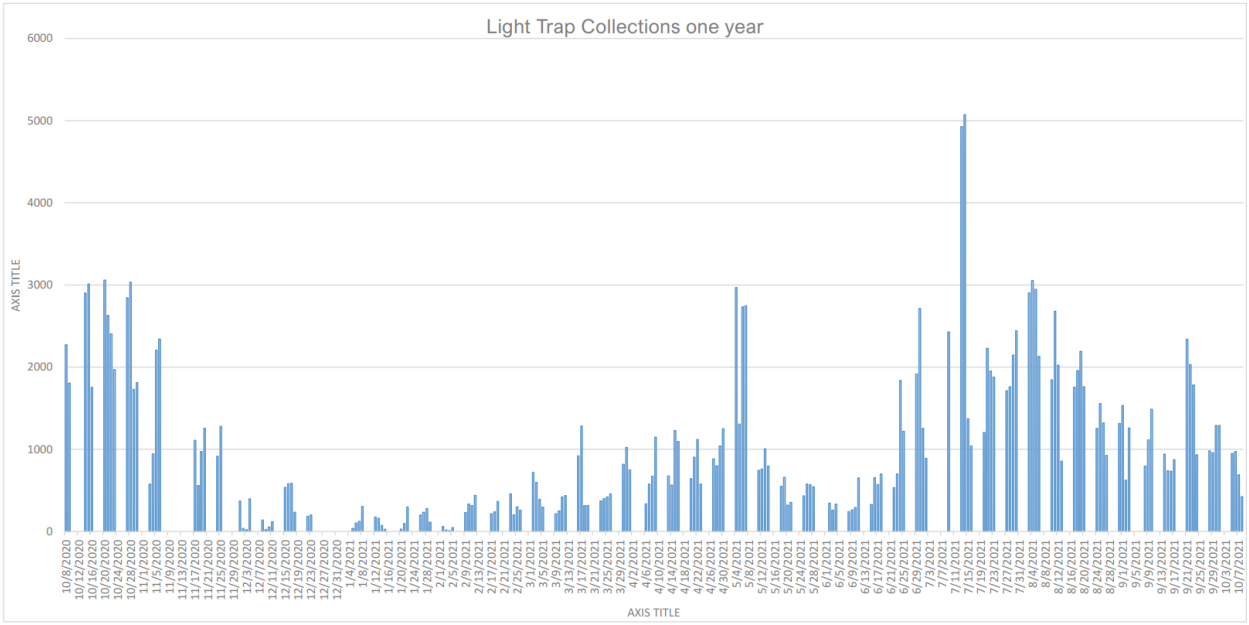


Zones highlighted in yellow on the map below were sprayed by truck this week.

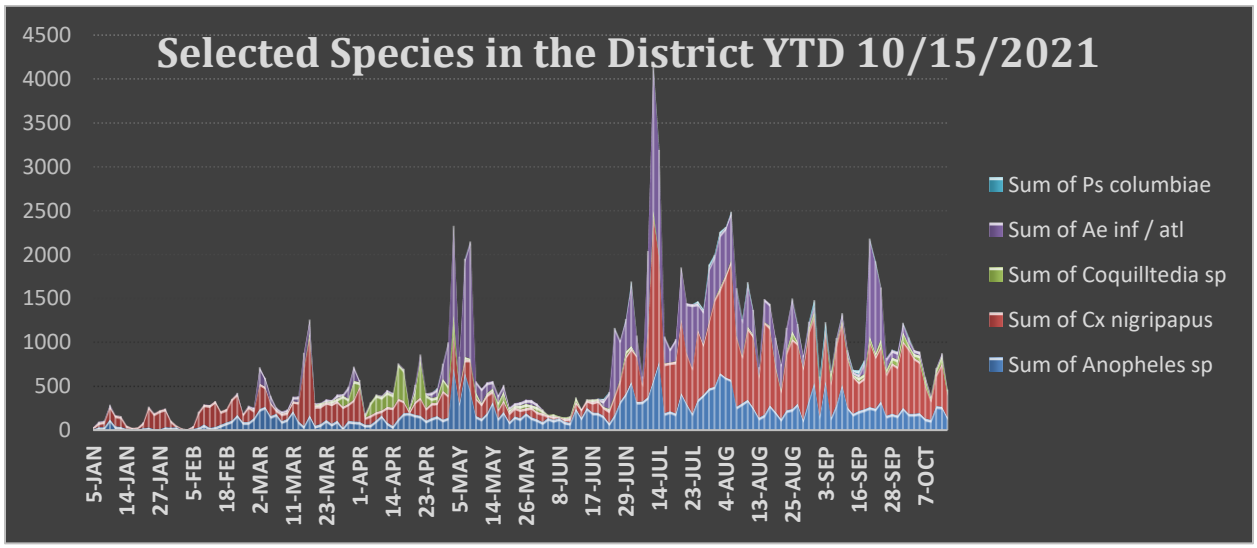


Week of 10/11/2021 Operations Update

Culex nigripalpus population bounced back this week which necessitated control measures in select zones. Floodwater species of mosquitoes have nearly disappeared from daily trap collections. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



October can have significant numbers of mosquitoes as seen in the above chart, but with little rainfall recently and little rainfall anticipated, a quieter October and November seems likely. *Anopheles* species are near baseline levels of population and *Culex nigripalpus* has been less widespread, indicating some breeding areas are no longer holding water (graph below).



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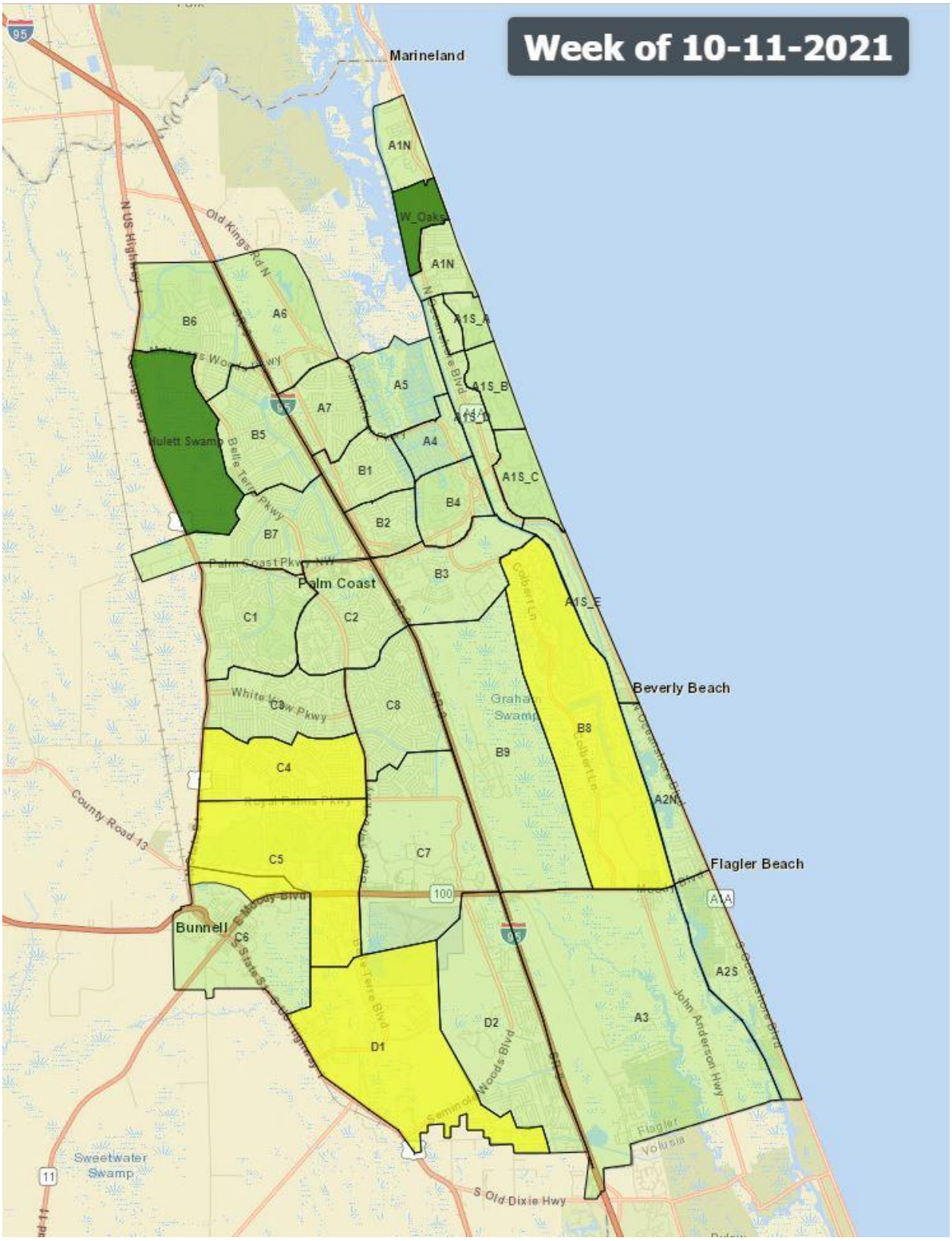
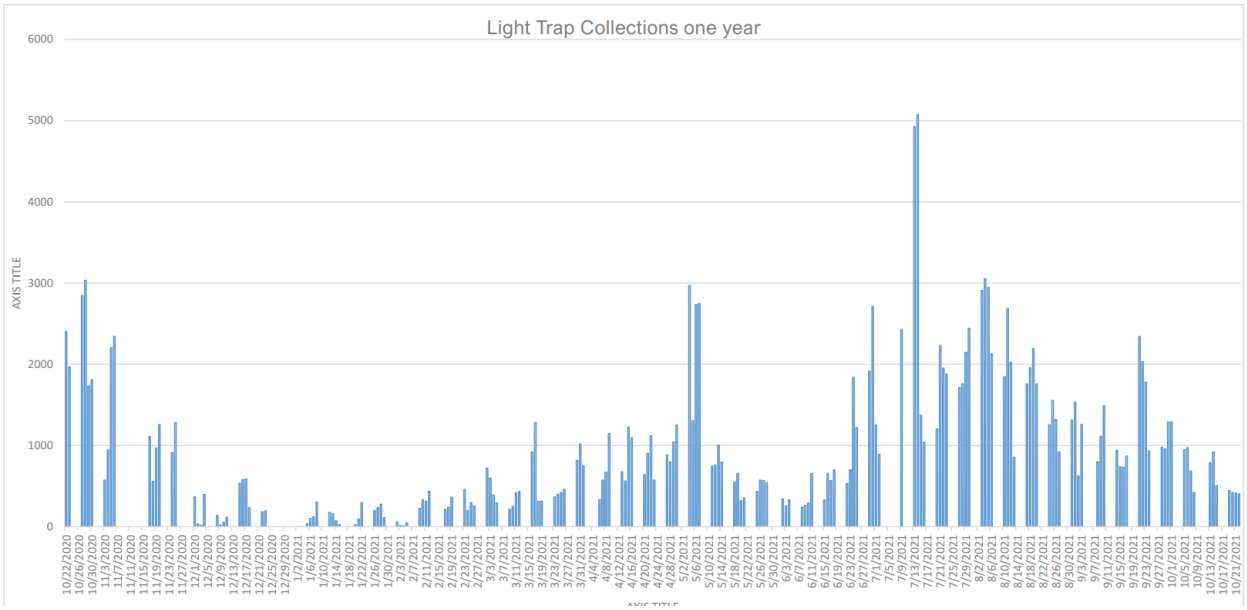
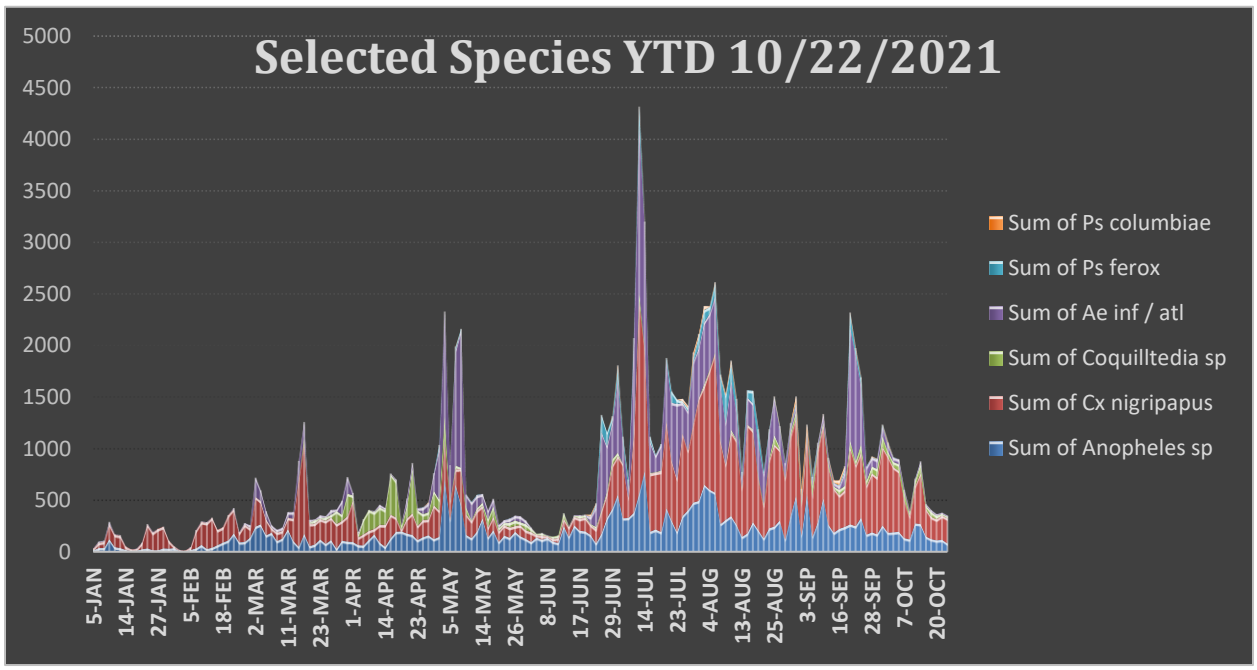


Week of 10/18/2021 Operations Update

A low level of mosquito activity this week with the trap counts fairly consistent. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



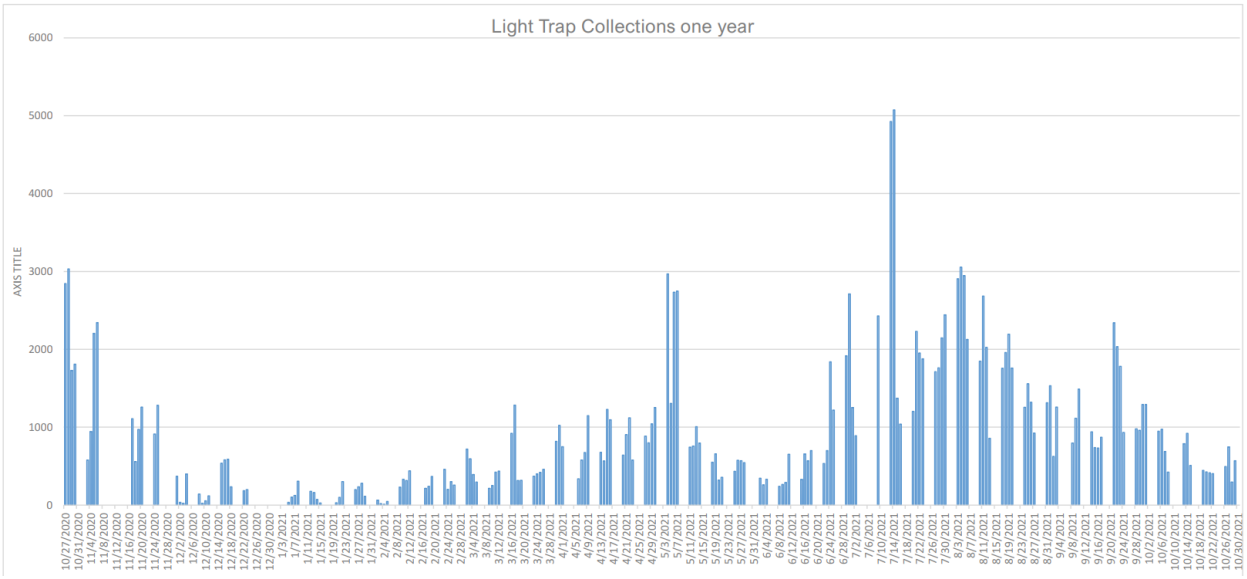
The most prevalent mosquito species trapped in the District this week were *Anopheles spp.* and *Culex nigripalpus.* Both species are below action thresholds, meaning their numbers do not warrant treatment (graph below).



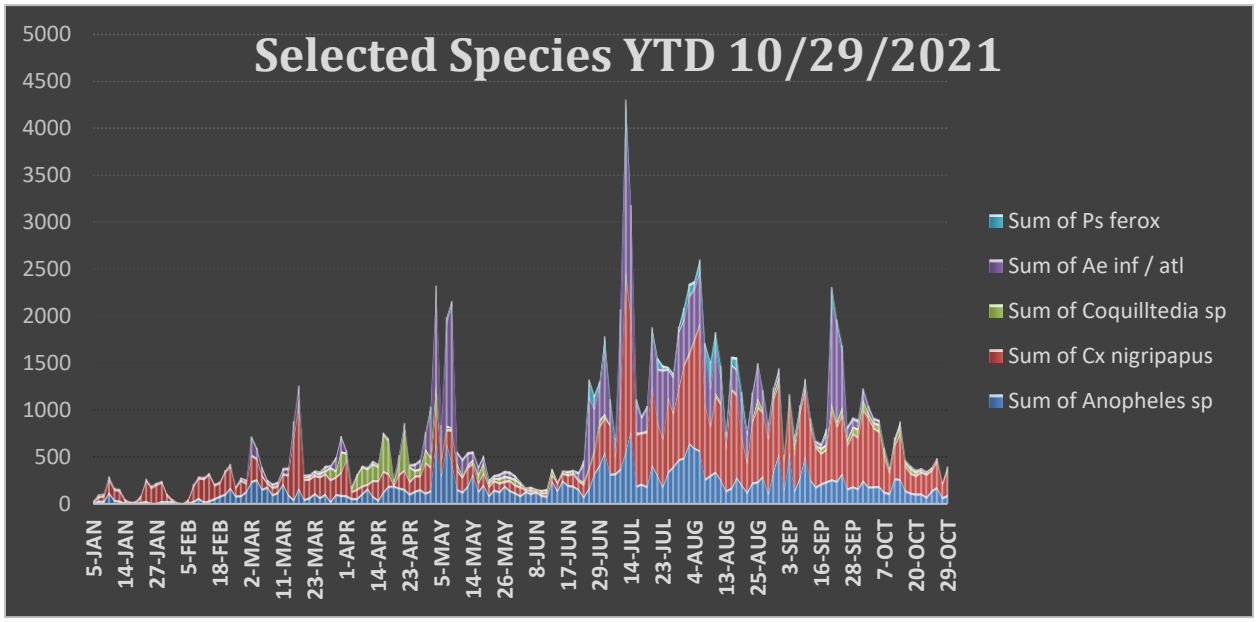
No spraying this week.

Week of 10/25/2021 Operations Update

Some cooler weather before Halloween limited mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The most prevalent mosquito species trapped in the District this week was *Culex nigripalpus* (graph below). Only one zone South of HWY 100 within the District warranted treatment.



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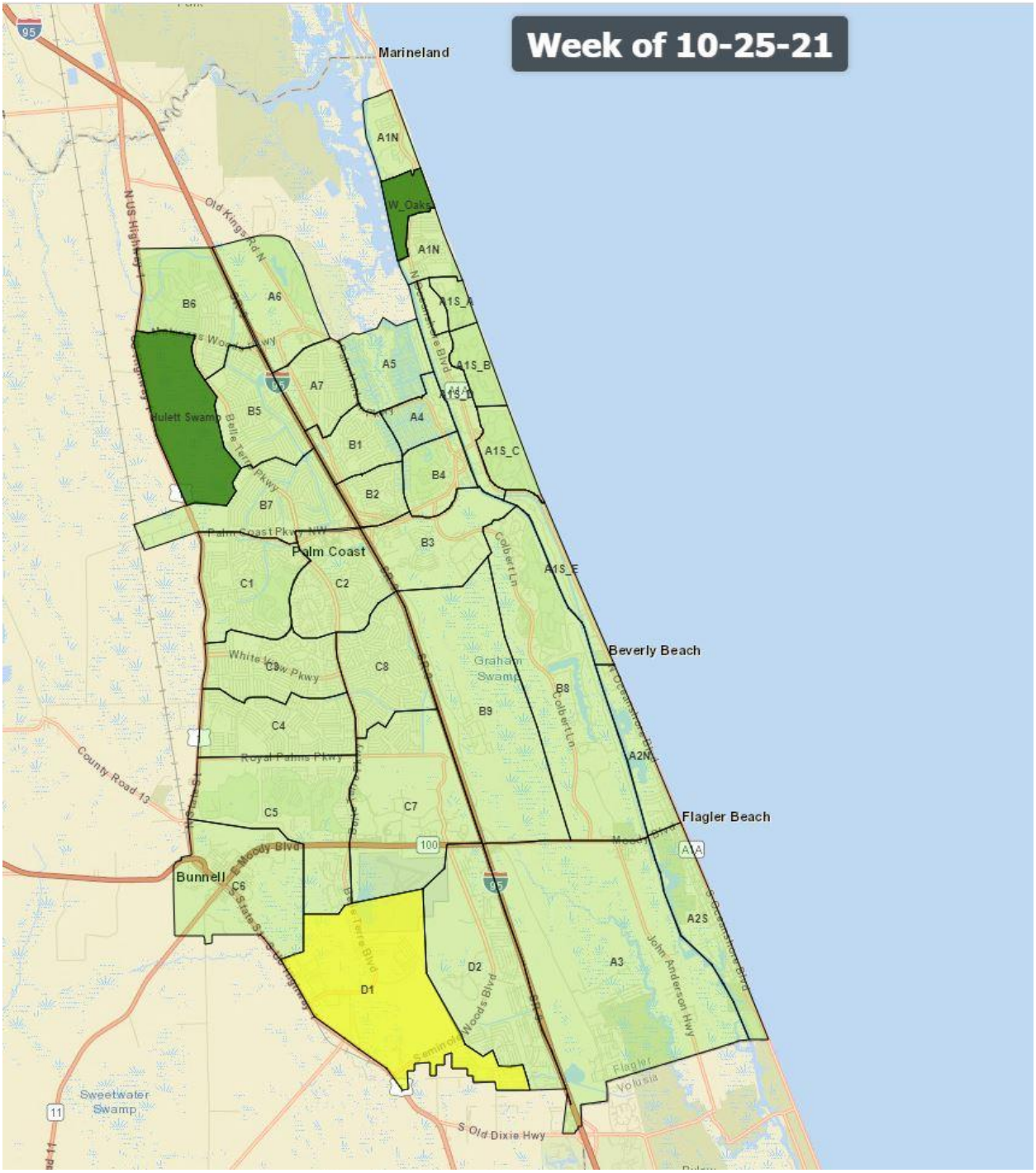
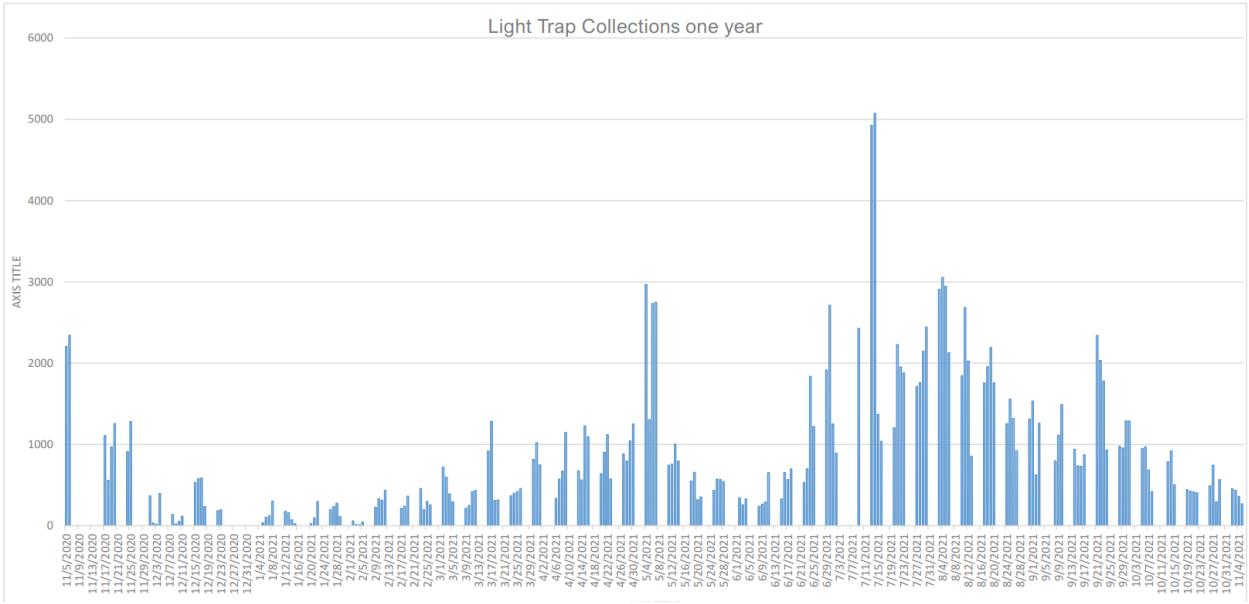
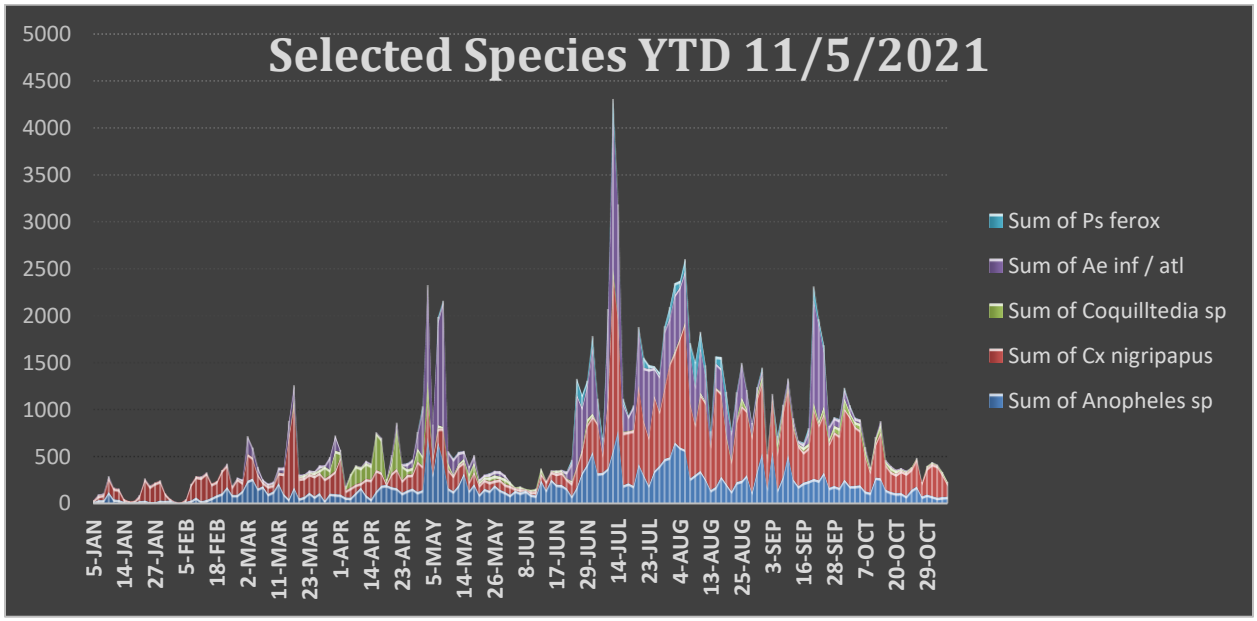


Week of 11/1/2021 Operations Update

Mosquito activity was more distributed and overnight temperatures were warmer, allowing us the opportunity to spray for adult mosquitoes. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The most prevalent mosquito species trapped in the District this week was *Culex nigripalpus* (graph below). Mosquitoes are less active when temperatures are low, the air is dry and winds are higher. When we apply pesticides to treat for flying adult mosquitoes it is critical that they are actively flying so they contact the very small droplets (less than 20 microns) of pesticide put out with our specialized spray equipment. If the temperatures, or other conditions, are not suitable the pesticide we will not be able to contact the flying mosquitoes an will therefore not be effective in controlling them.



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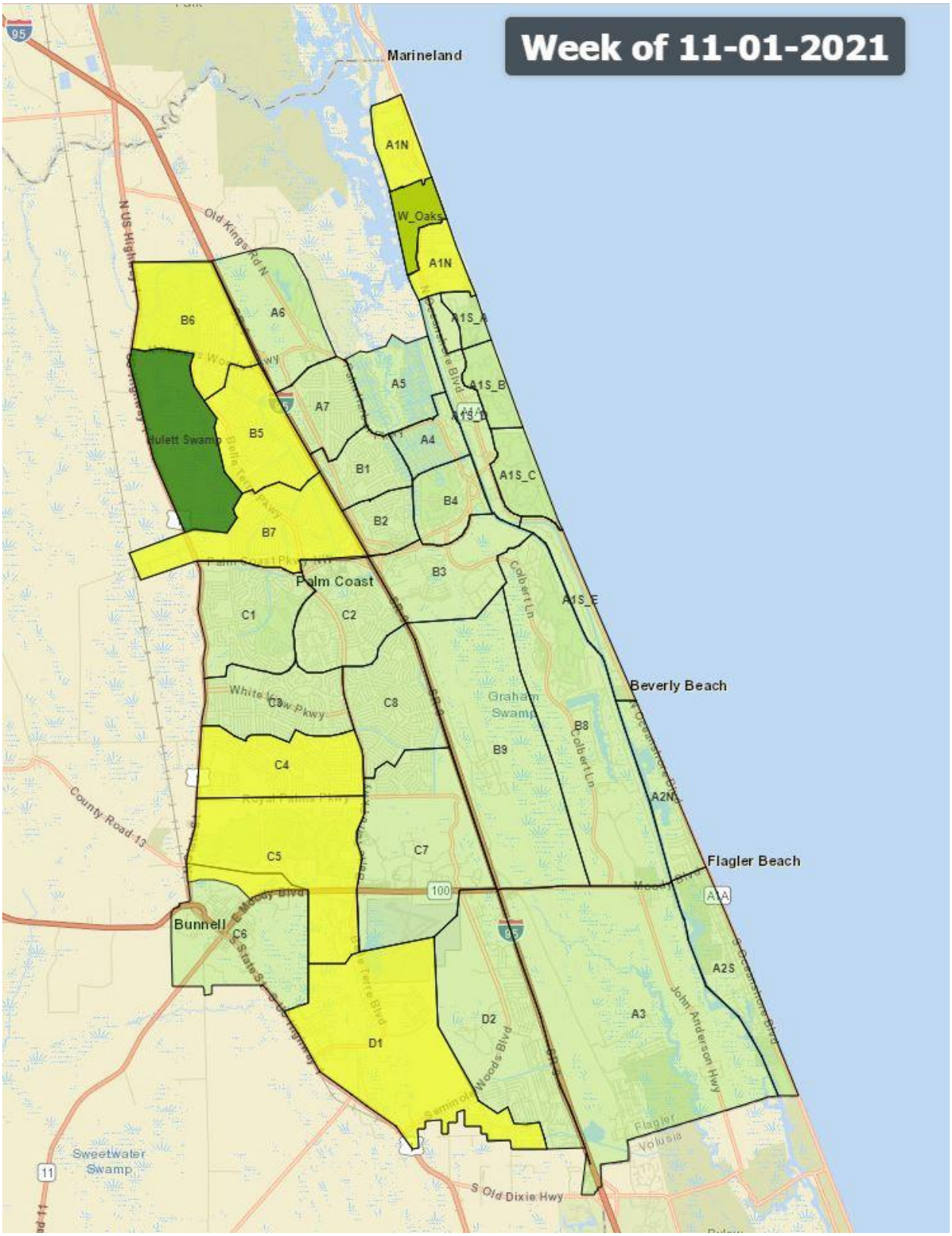
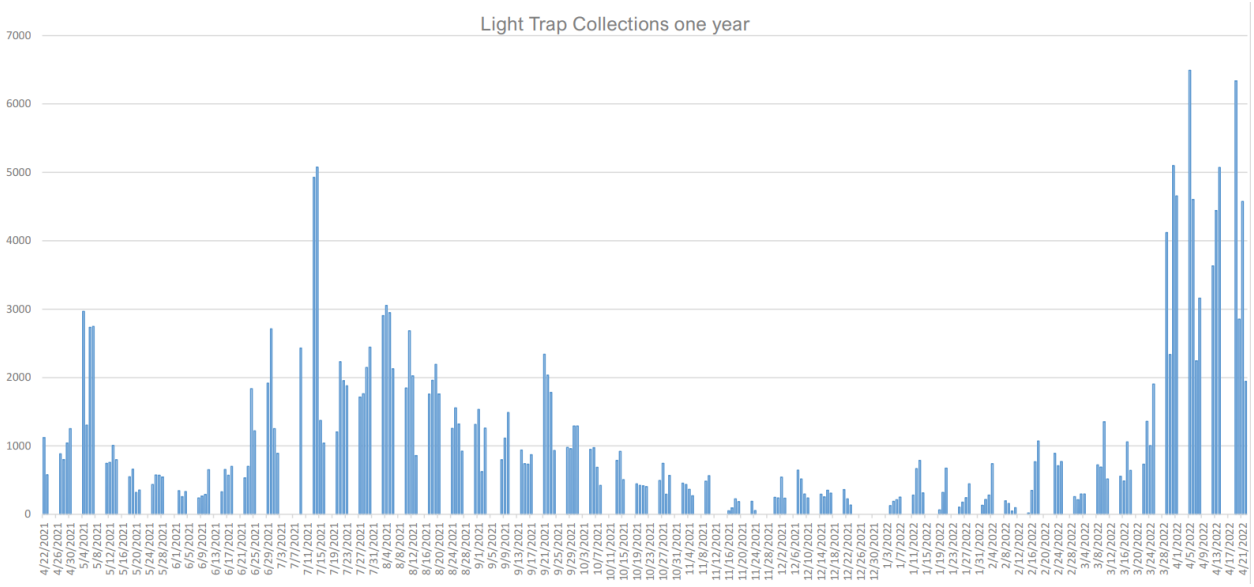


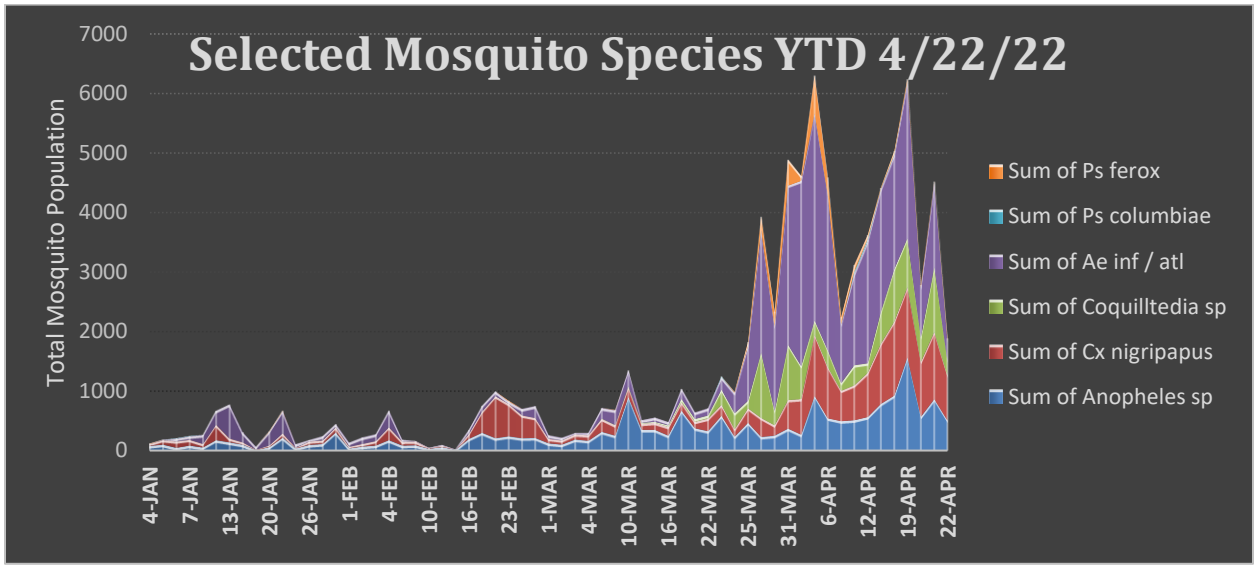
Week of 4/18/2022 Operations Update

Mosquito activity was most abundant in the south portion of the District and overnight temperatures were warmer, allowing us the opportunity to spray for adult mosquitoes. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).

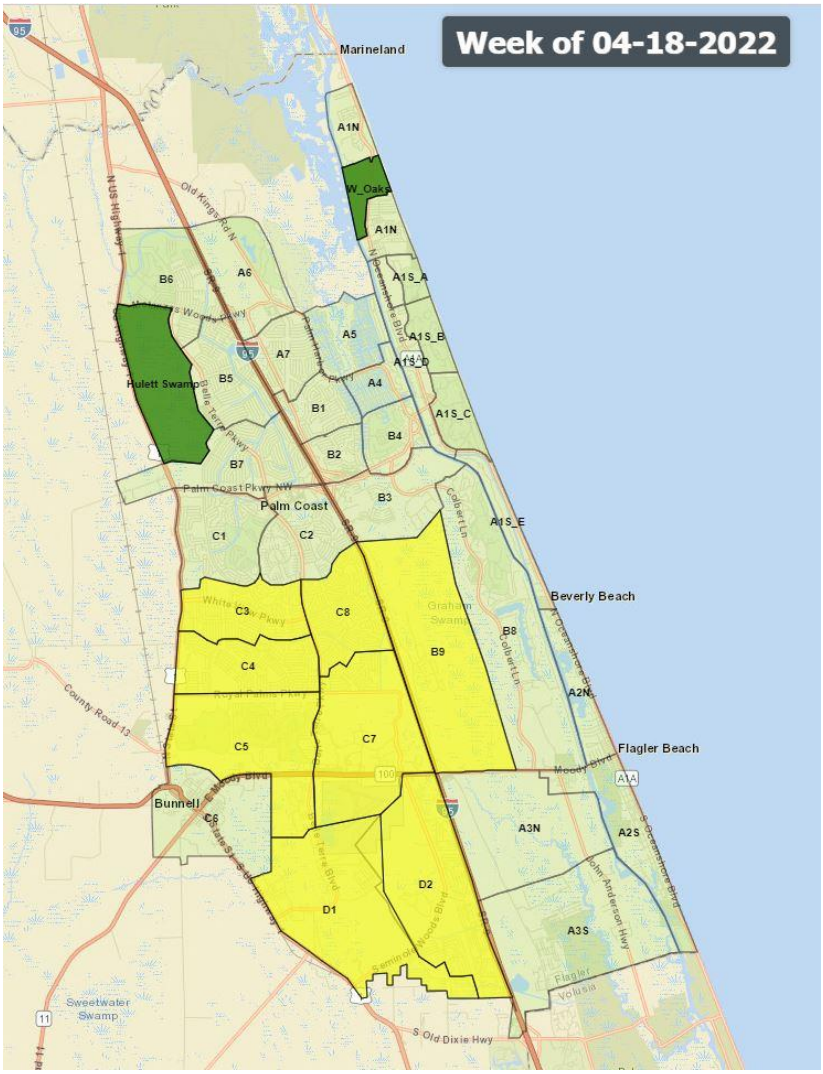


The flood-water species *Aedes infirmatus* has been the most abundant mosquito species in the traps for the past month (Chart below). The permanent-water species *Coquilletidia perturbans* continues its spring emergence from the freshwater swamps that occur mostly in the southern most portions of the District. Additional prevalent species are listed as well in the chart below. While these differing species may prefer different breeding habitats, have different flight ranges, and vary in their aggression towards biting of people, we track and control them using the same methodology.

When populations exceed an action threshold then we can apply pesticides to limit their abundance. Mosquitoes are less active when temperatures are low, the air is dry and conditions are windy. When we apply pesticides to treat for adult mosquitoes it is critical that they are actively flying so they contact the very small droplets (less than 20 microns) of pesticide put out with our specialized spray equipment. If the temperatures or other conditions are not suitable, the small droplets of pesticide will not be able to make contact with flying mosquitoes and will therefore not be effective in reducing their numbers.

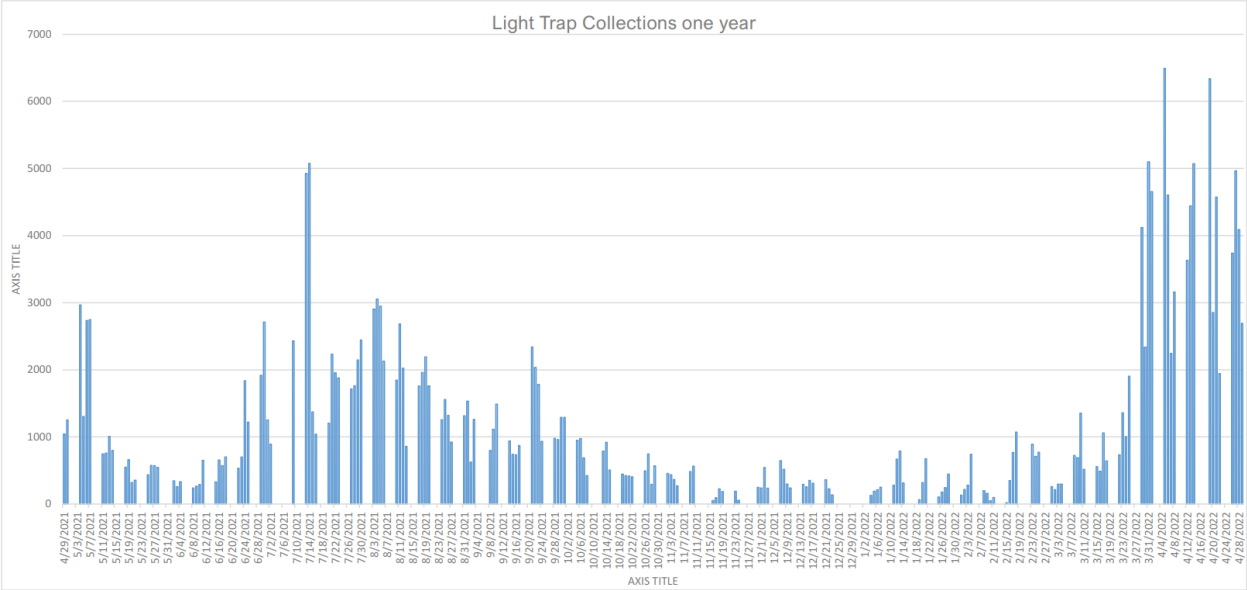


Zones highlighted in yellow on the map below were sprayed by truck this week.

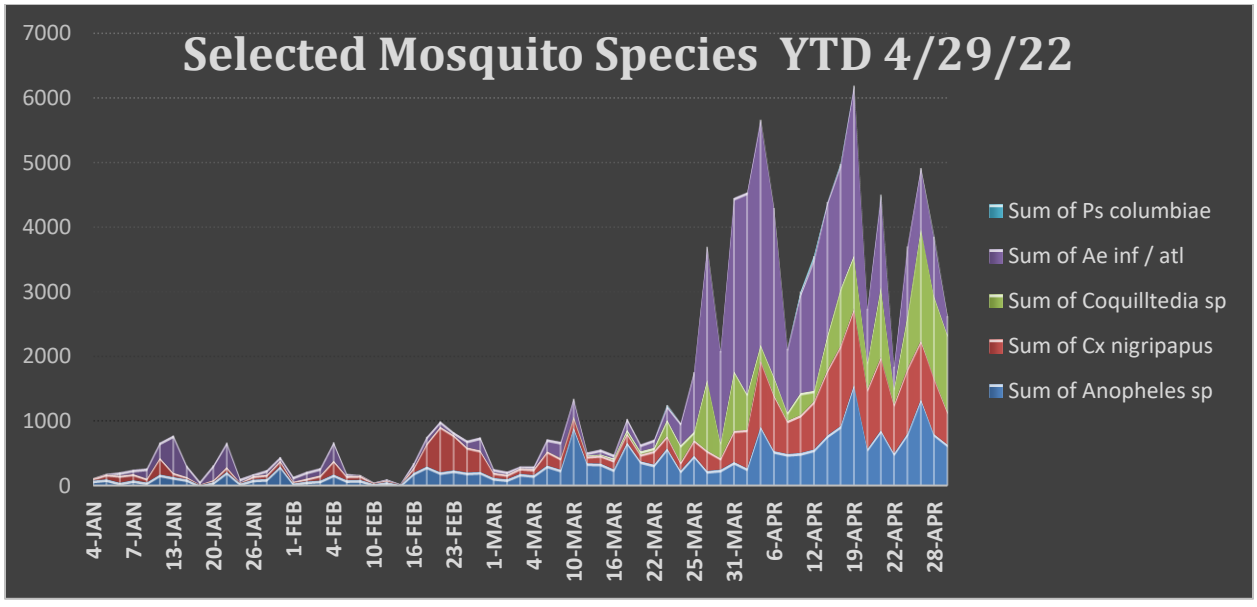


Week of 4/25/2022 Operations Update

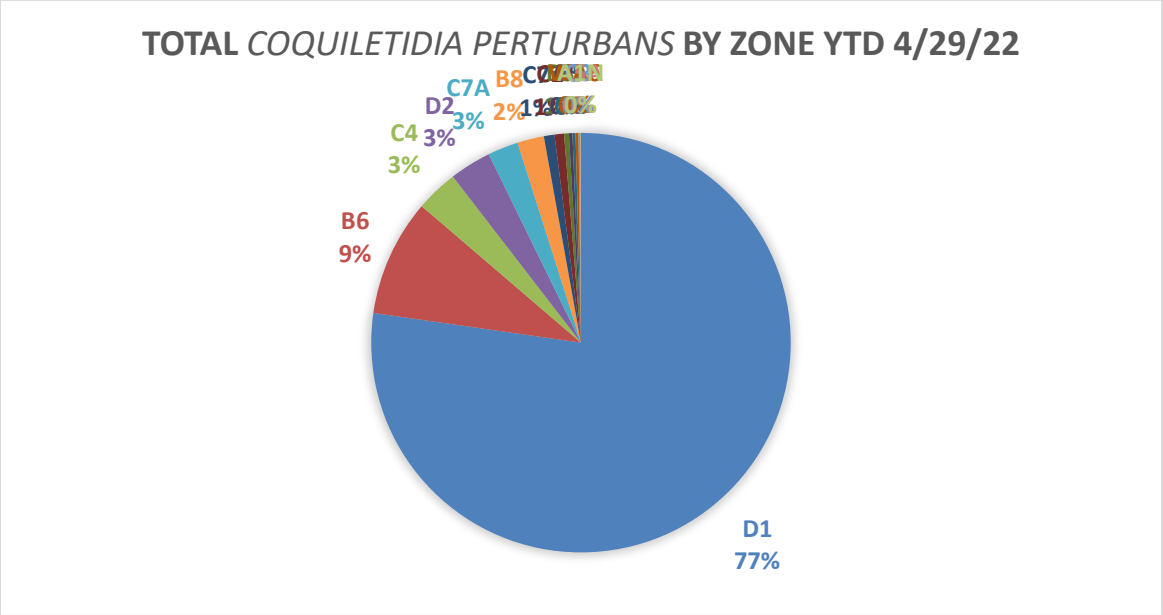
After spraying last week for mosquitoes in the south and central portions of the Eastern side of the District, mosquito activity was most abundant in the north portion of the District. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



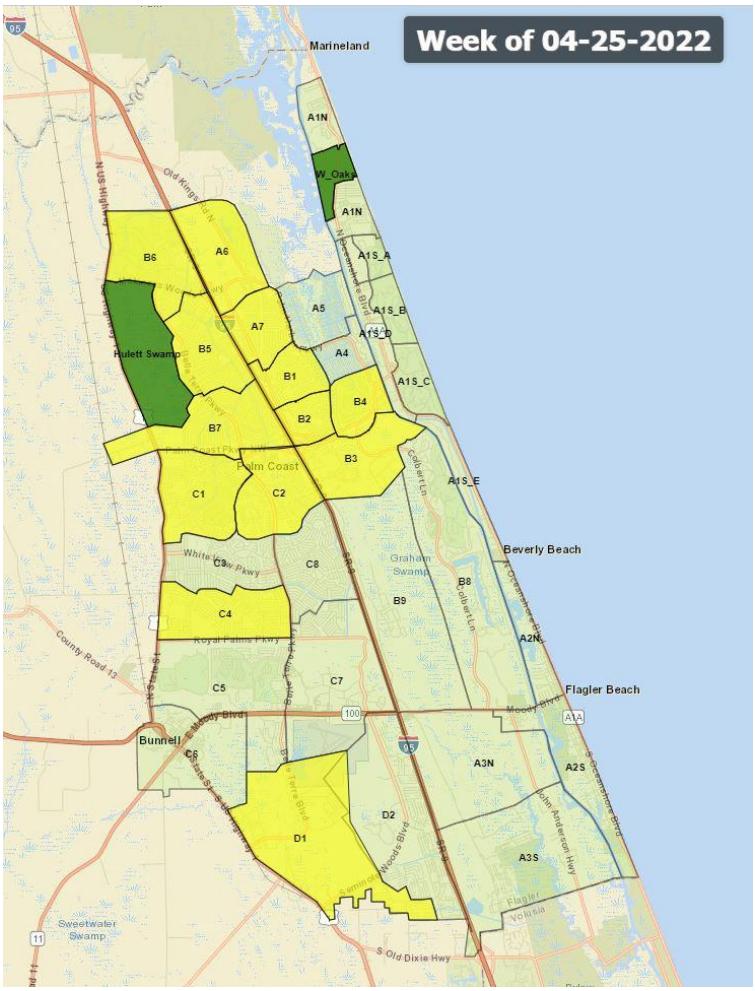
This week saw less of the flood-water species *Aedes infirmatus* that had been the most abundant mosquito species in the traps since late-March (Chart below). The permanent-water species *Coquilletidia perturbans* continues its spring emergence from the freshwater swamps that occur mostly in the southern most portions of the District and became the most dominant species in terms of total numbers. Additional prevalent species are listed as well in the chart below.



The chart below shows the proportion of *Coquiletidia perturbans* trapped in each zone. You can see better than ¾ are from zone D1 encompassing Quail Hollow. This subdivison is less densely developed due the presence of fresh water swamps that this species of mosquito calls home.

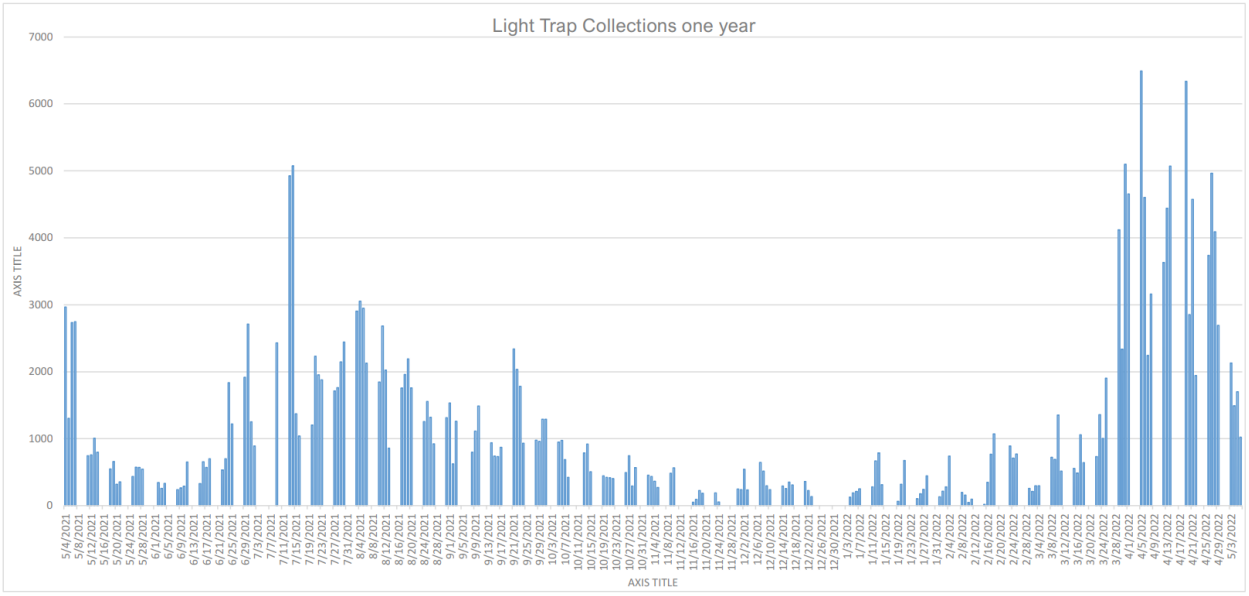


Zones highlighted in yellow on the map below were sprayed by truck this week.

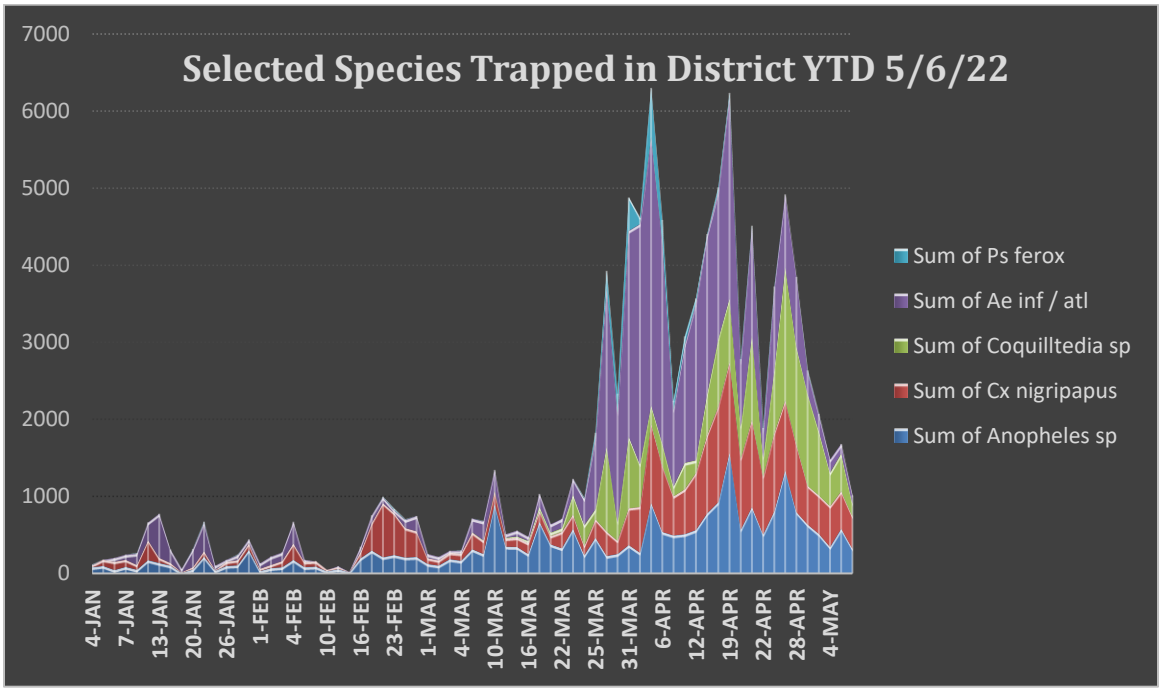


Week of 5/2/2022 Operations Update

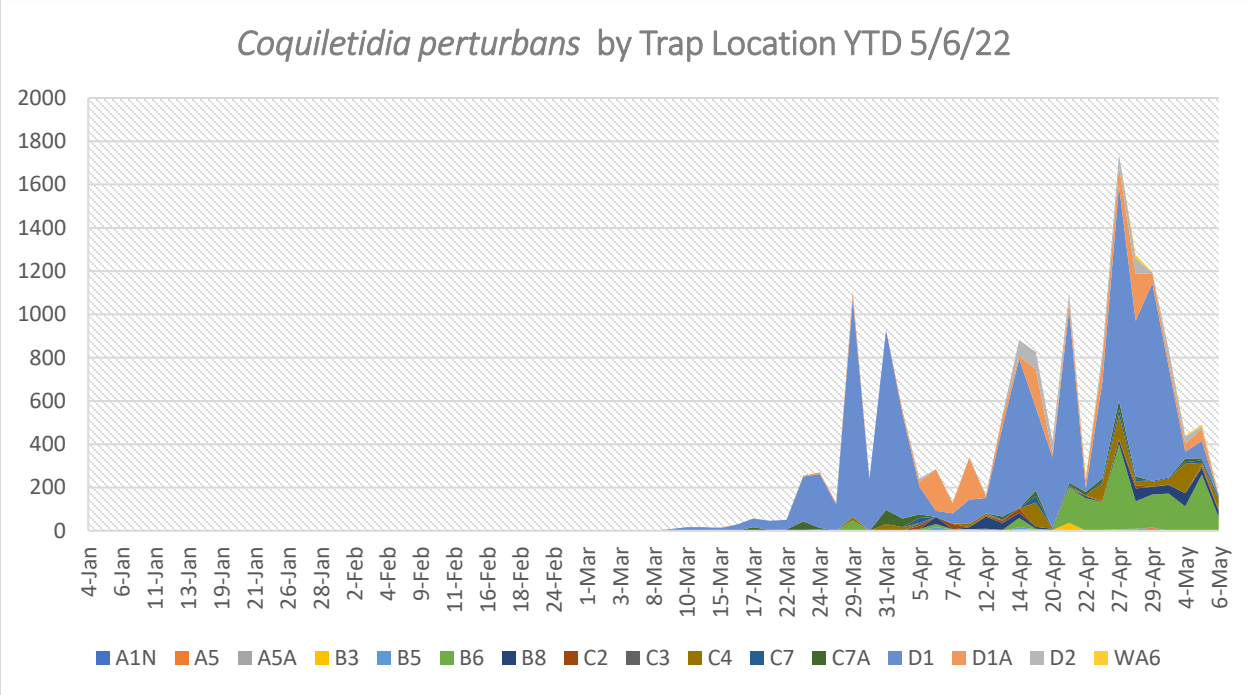
Adulticide treatments this week focused on the mosquito species *Coquilletidia perturbans*. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



With the flood-water species *Aedes infirmatus* in decline, the most abundant mosquito species trapped in the District this week was permanent-water species *Coquilletidia perturbans.* Beginning in spring, whether it rains or not, this species emerges from the freshwater swamps after surviving the winter as larvae (Chart below). This species is an important bridge vector of Eastern Equine Encephalitis. It spreads this disease by feeding on infected birds that live in freshwater swamps, the mosquito then becomes infected with the virus and can spread it to humans. Keeping the population of this mosquito in check minimizes the chances of humans becoming infected in populated areas.



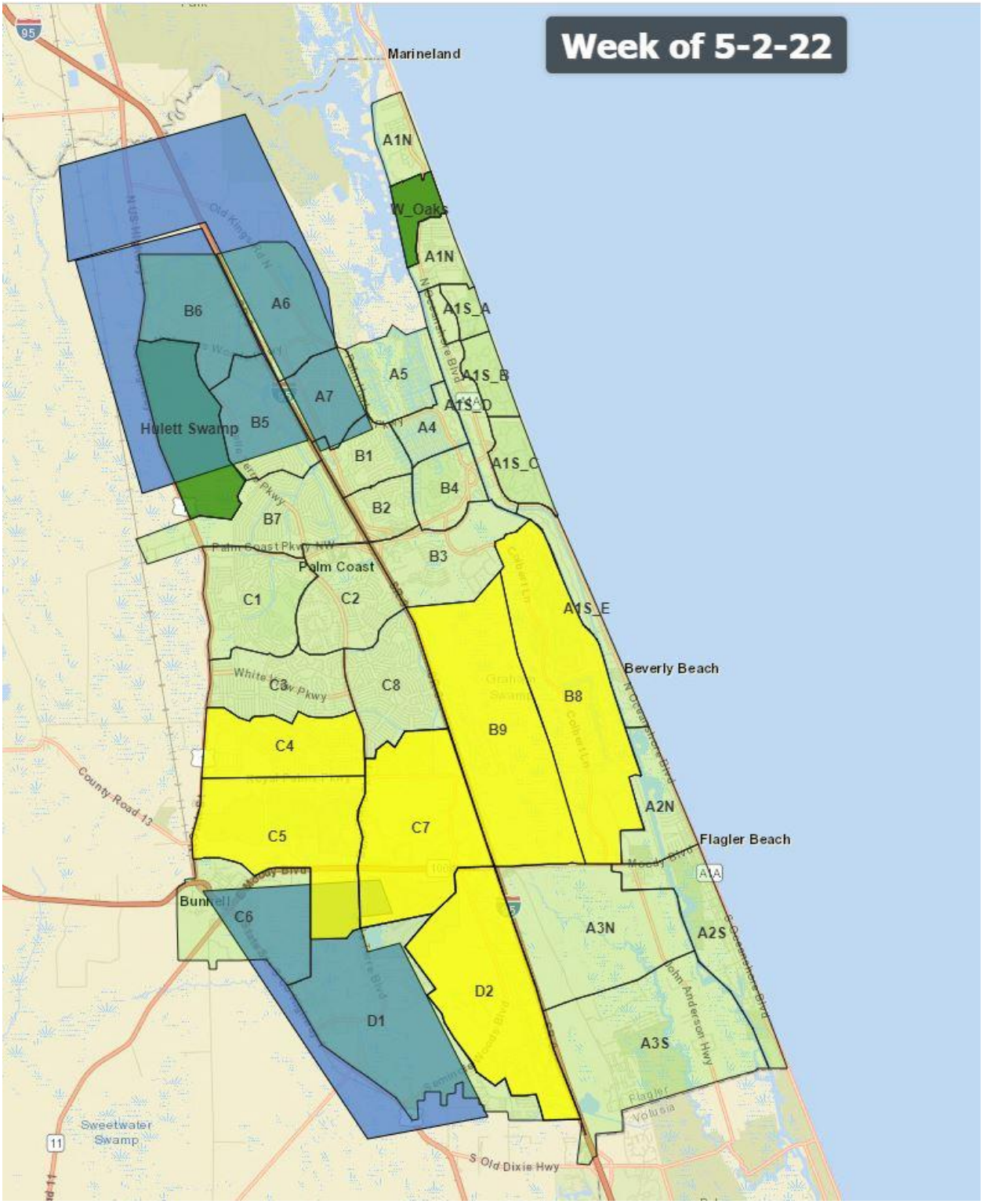
The chart below shows the proportion of *Coquiletidia perturbans* trapped in each zone each day. You can see zone D1 encompassing Quail Hollow has the majority of this species of mosquito. This subdivison is less densely developed due the presence of fresh water swamps that this species of mosquito calls home. Matanzas Woods is runner up, but with the species primarily infiltrating from outside the subdivision to the North and to the West, rather than from within as well.



Another disease transmitted by mosquitoes that we do not hear much about anymore but was once abundant in Florida is Malaria. However, travel related cases do occur from residents of Flagler County returning home with the infection. We have had only one so far this year. Once the Dpeartment of Health has a case reported, they relay that information to the District so we can assess the area to ensure no local tansmission is possible.

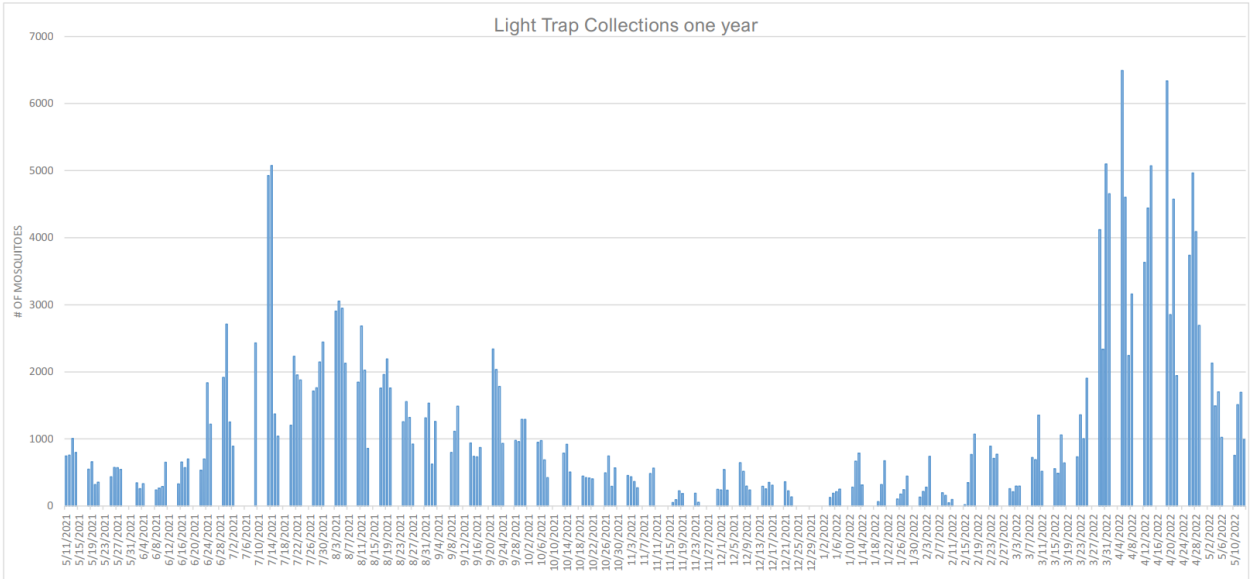
Accoriding to the Department of Health, “In Florida, there are eight identifiable Anopheles species, all of which are potentially capable of transmitting malaria; however only one, *Anopheles quadrimaculatus*, is a major malaria vector in Florida.” (DOH Citation) While we now think of malaria as a disease that only affects the developing world, Florida and the Southeast had endemic malaria. Mosquito control, improved infrastructure, and medical treatments eliminated malaria from Florida by the end of the 1930’s. But the potential does still exist for transmission, “In June 1990, Florida had its first case of human malaria (P. vivax) in 42 years, acquired presumably through the bite of a mosquito in Gulf County.”

Zones highlighted in yellow on the map below were sprayed by truck, blocks in blue were treated by helicopter this week.

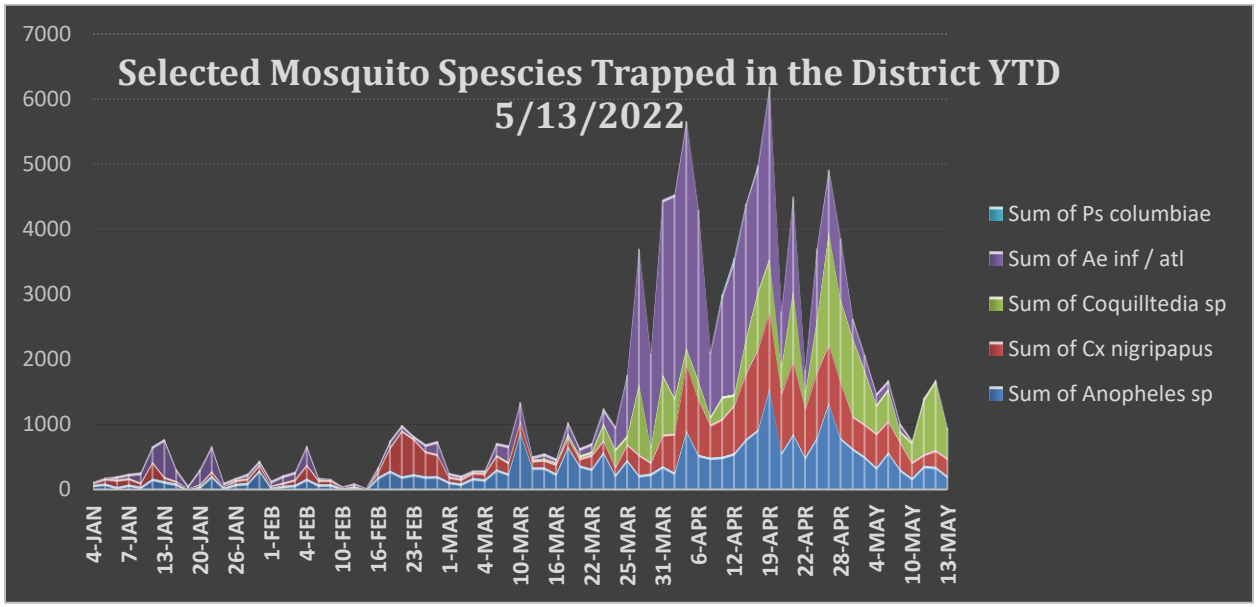


Week of 5/9/2022 Operations Update

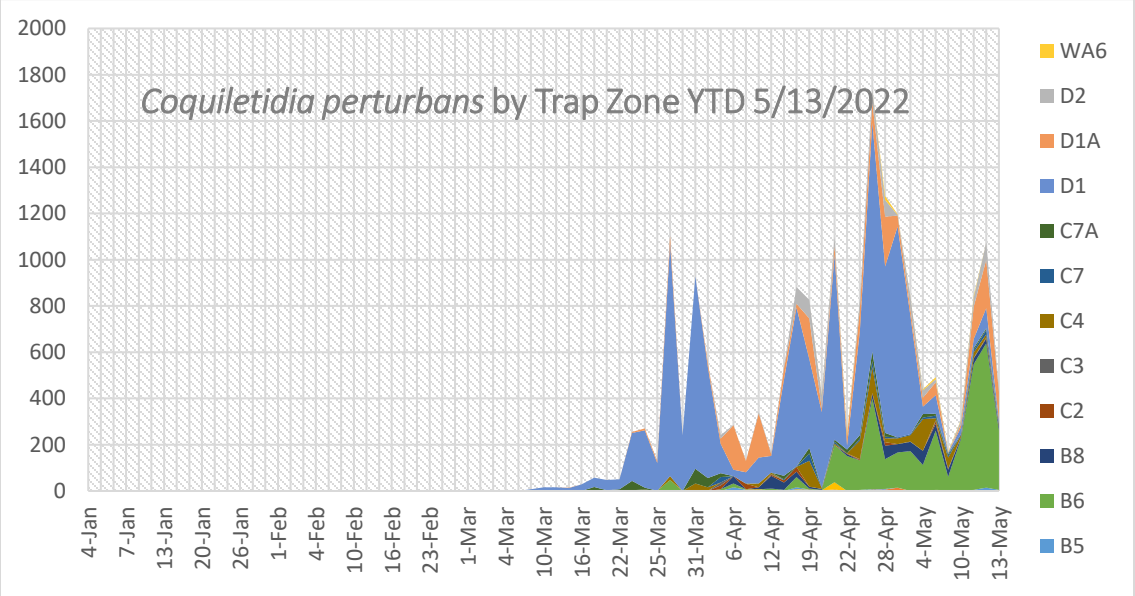
No adulticide treatments this week. First round of aerial larvicide pre-treatments for the year were completed in the saltmarsh this week. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The flood-water species *Aedes infirmatus* was almost non-existent this week, while the most abundant mosquito species trapped in the District this week was permanent-water species *Coquilletidia perturbans* (Chart below).



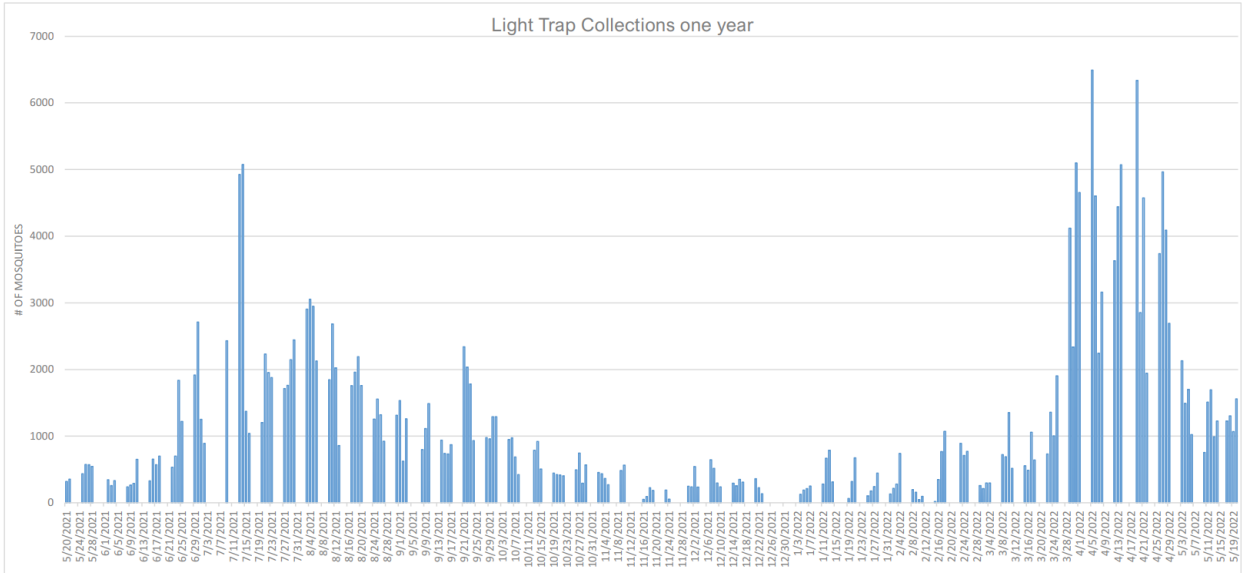
The chart below shows the proportion of *Coquiletidia perturbans* trapped in each zone each day. You can see zone D1 encompassing Quail Hollow has the majority of this species of mosquito. This subdivison is less densely developed due the presence of fresh water swamps that this species of mosquito calls home. Matanzas Woods is runner up in total population of this species but is showing a late surge.



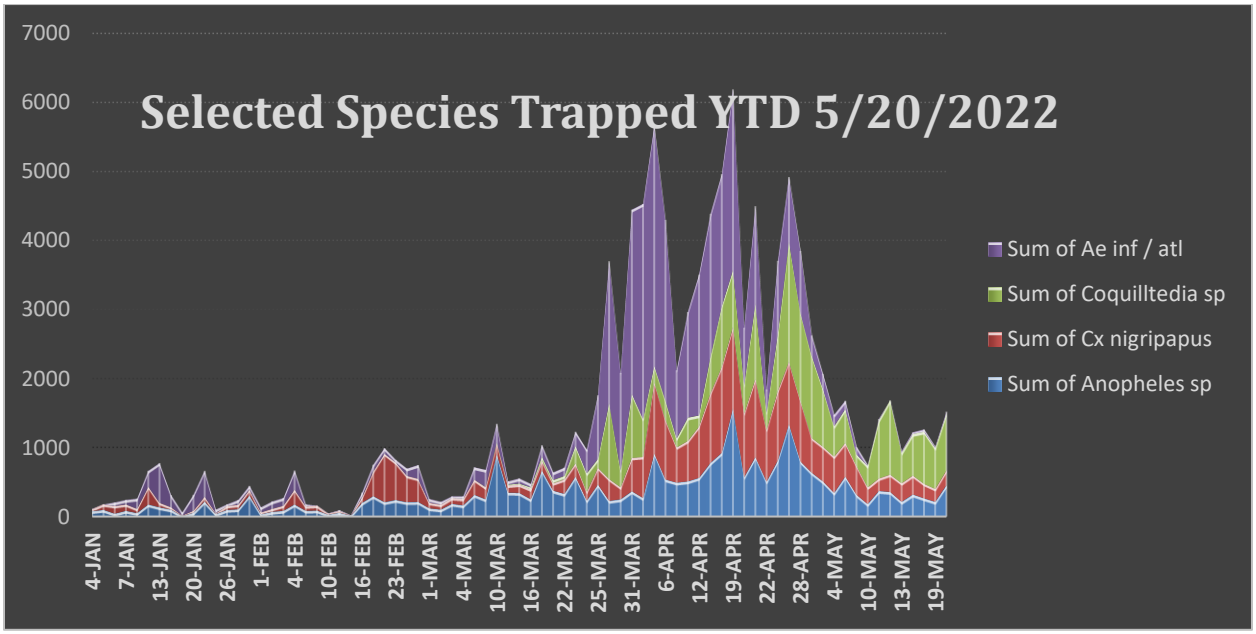
No adulticide treatments this week.

Week of 5/16/2022 Operations Update

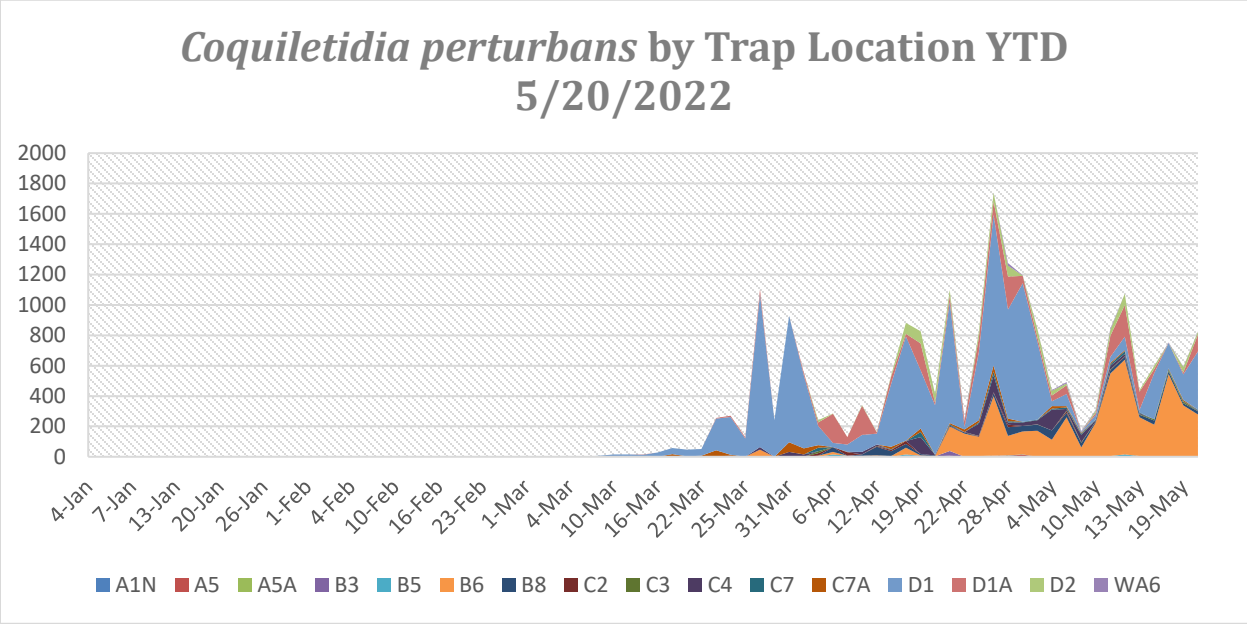
Adulticide treatments this week focused on the mosquito species *Coquilletidia perturbans*. Larvicide pre-treatments of the saltmarsh were completed this by ground and UAS. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



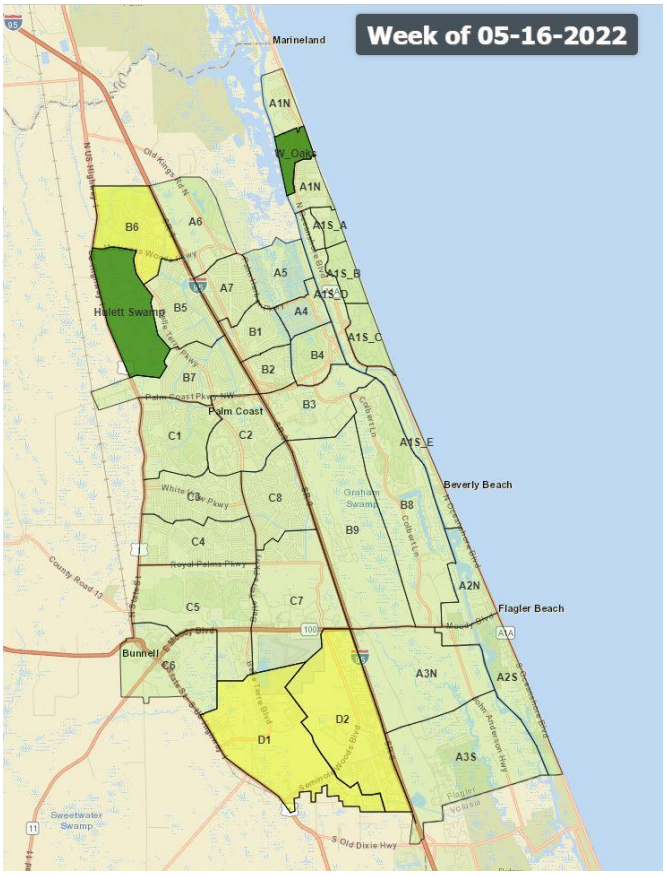
The permanent-water mosquito species *Coquilletidia* emerges from the freshwater swamps after surviving the winter as larvae beginning in spring, whether it rains or not (Chart below). This species of mosquitoes is an aggressive biter of people, has a flight range of up to ten miles and is a bridge-vector of Eastern Equine Encephalitis (EEE).



The chart below shows the proportion of *Coquiletidia perturbans* trapped in each zone each day. You can see zone D1 encompassing Quail Hollow has the majority of this species of mosquito. This subdivison is less densely developed due the presence of fresh water swamps that this species of mosquito calls home. Matanzas Woods is runner up, but with the species primarily infiltrating from outside the subdivision to the North and to the West, rather than from within. This week the species has roughly equivalent numbers in both locations.

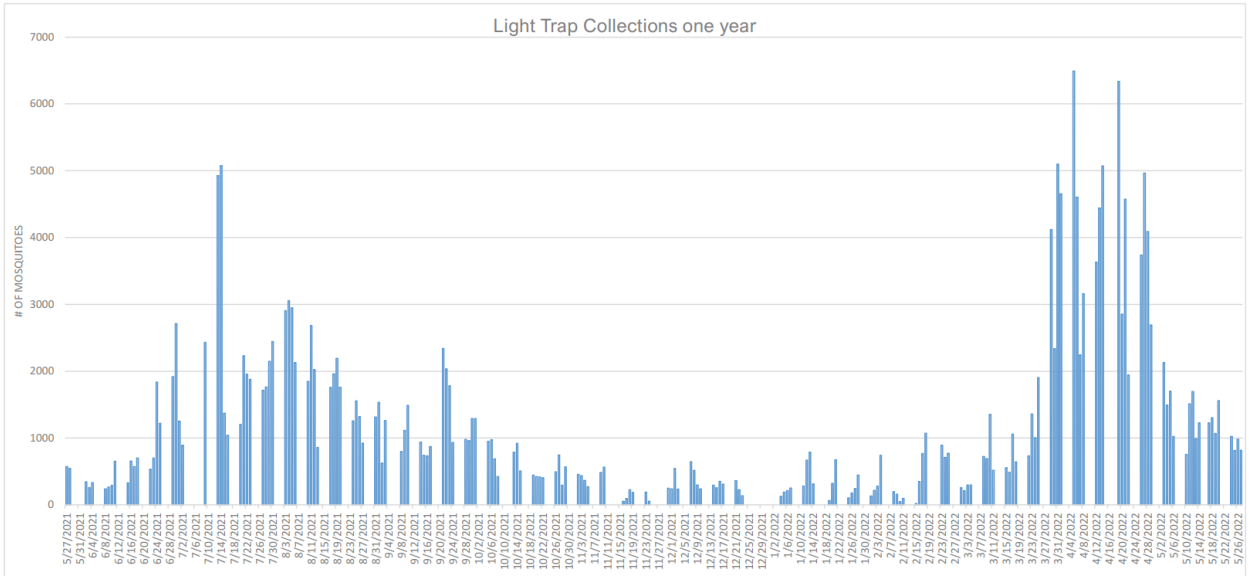


Zones highlighted in yellow on the map below were sprayed by truck this week.

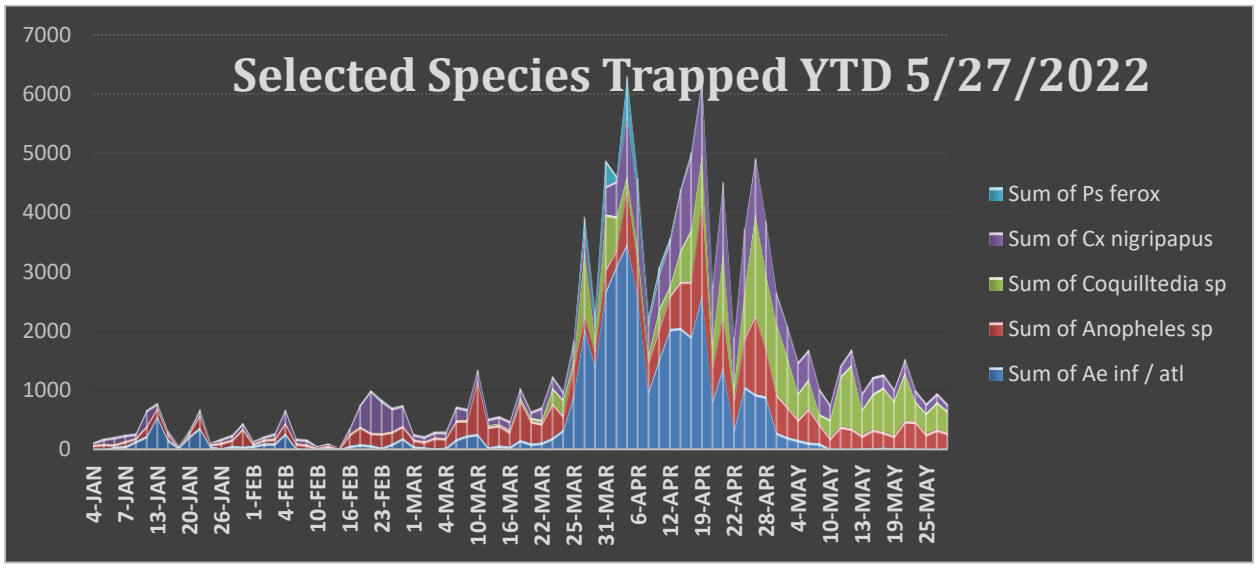


Week of 5/23/2022 Operations Update

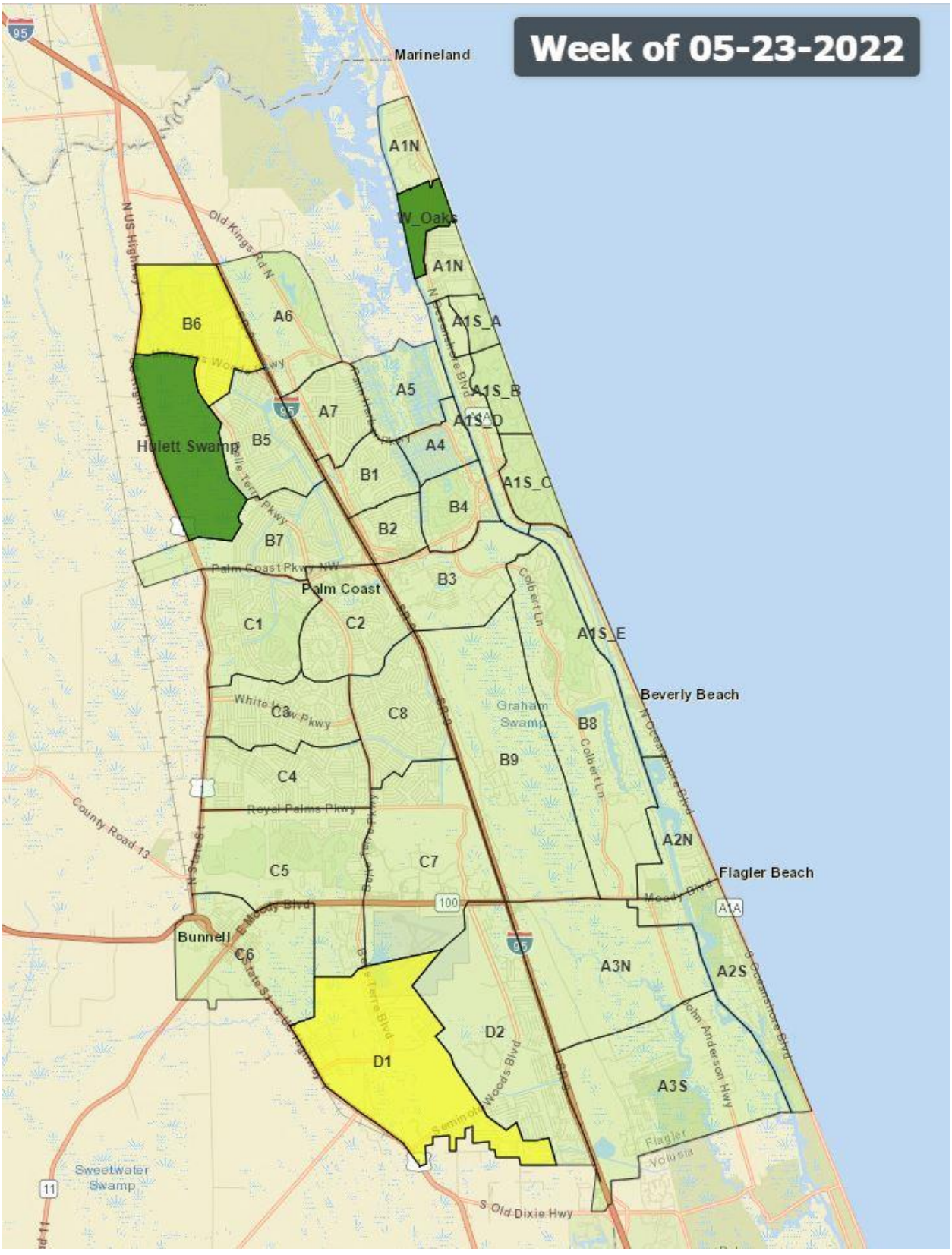
Low mosquito activity this week. Adulticide treatments this week focused on the mosquito species *Coquilletidia perturbans*. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The emergence of the permanent-water mosquito species *Coquilletidia perturbans* has begun to taper off (Chart below). Without continued emergence the species will continue to decline.

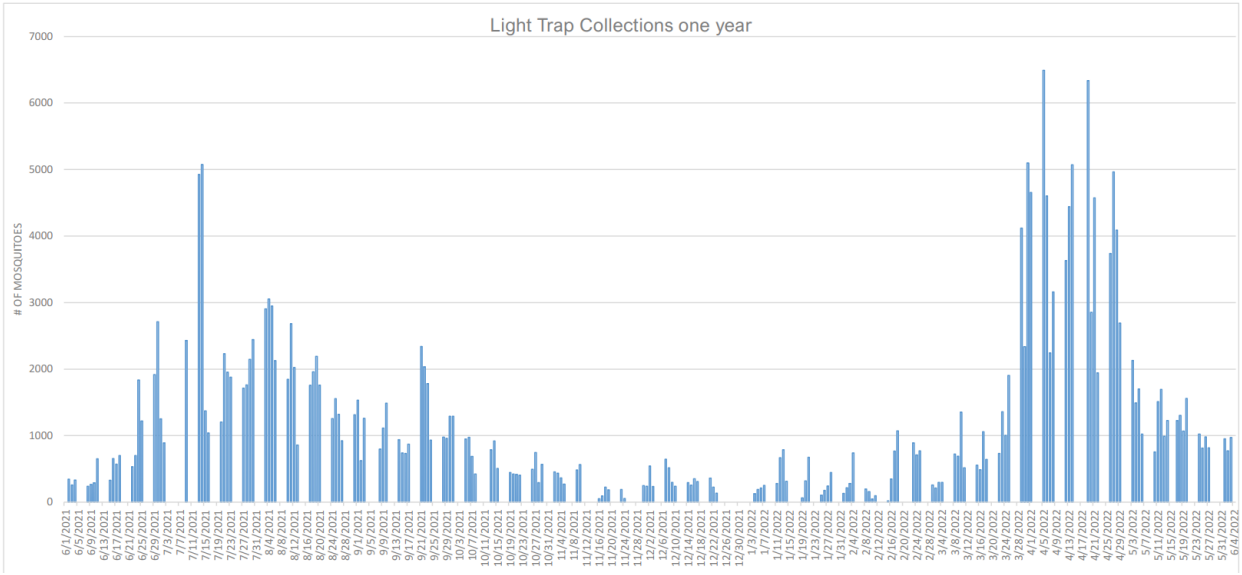


Zones highlighted in yellow on the map below were sprayed by truck this week.

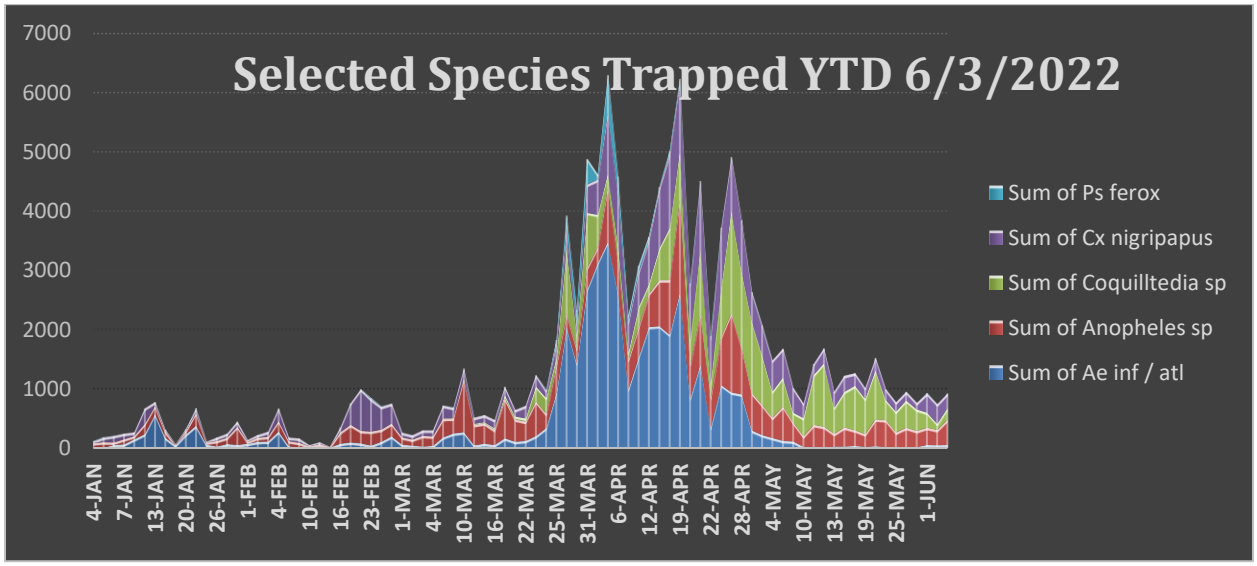


Week of 5/30/2022 Operations Update

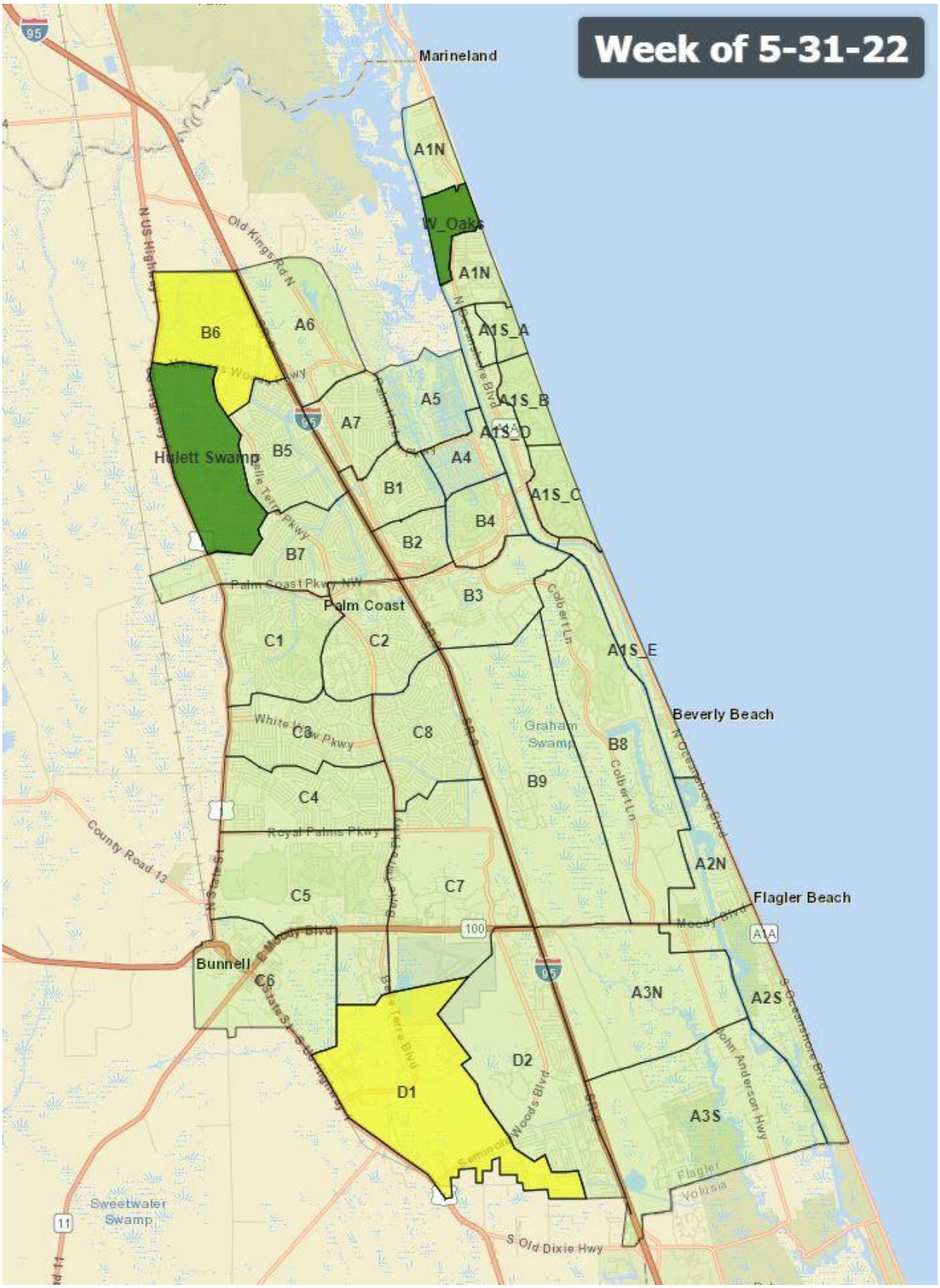
Second week of low mosquito activity. Adulticide treatments this week focused on the mosquito species *Coquilletidia perturbans*. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The permanent-water mosquito species *Coquilletidia perturbans* is on the wane now that it's spring emergence is at an end (Chart below).

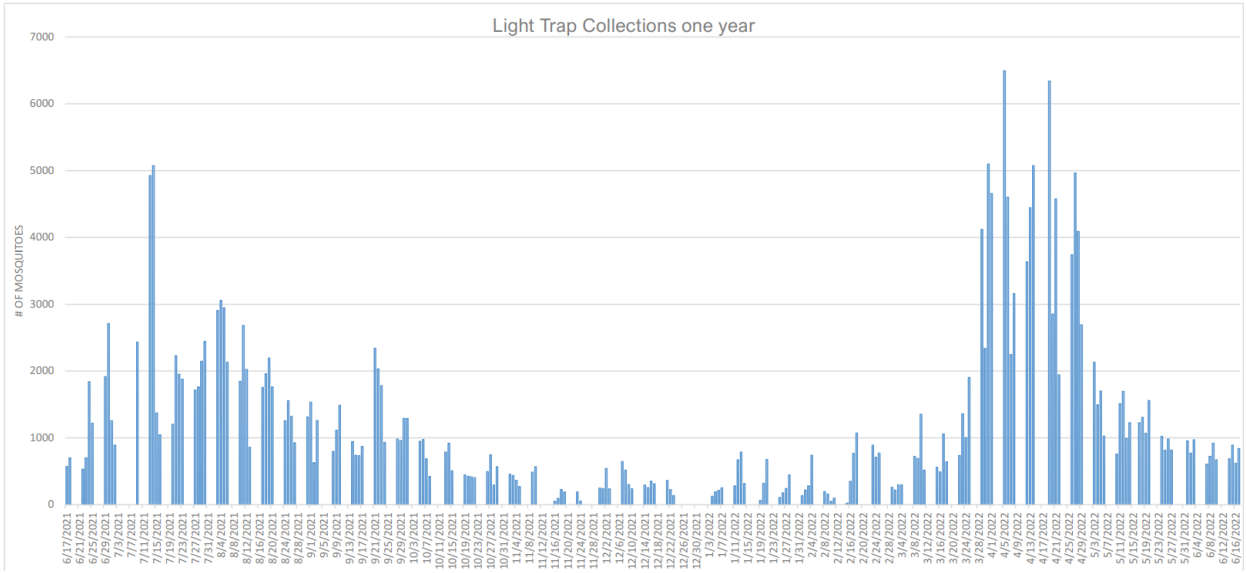


Zones highlighted in yellow on the map below were sprayed by truck this week.

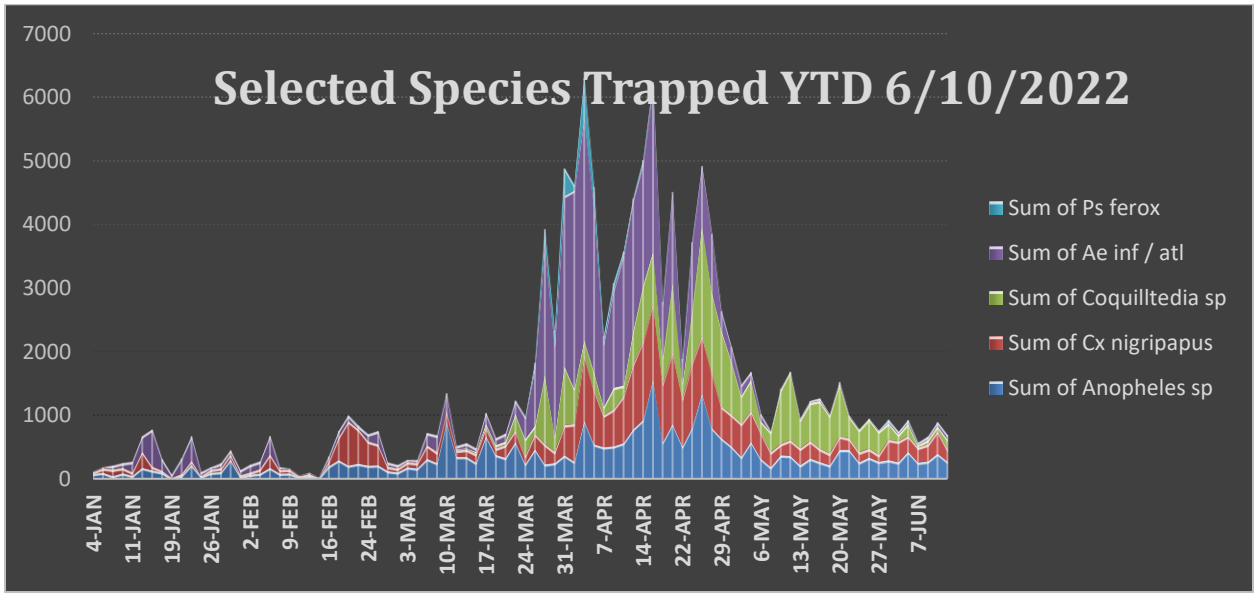


Week of 6/6/2022 Operations Update

Third week of low mosquito activity. No adulticide spraying this week. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



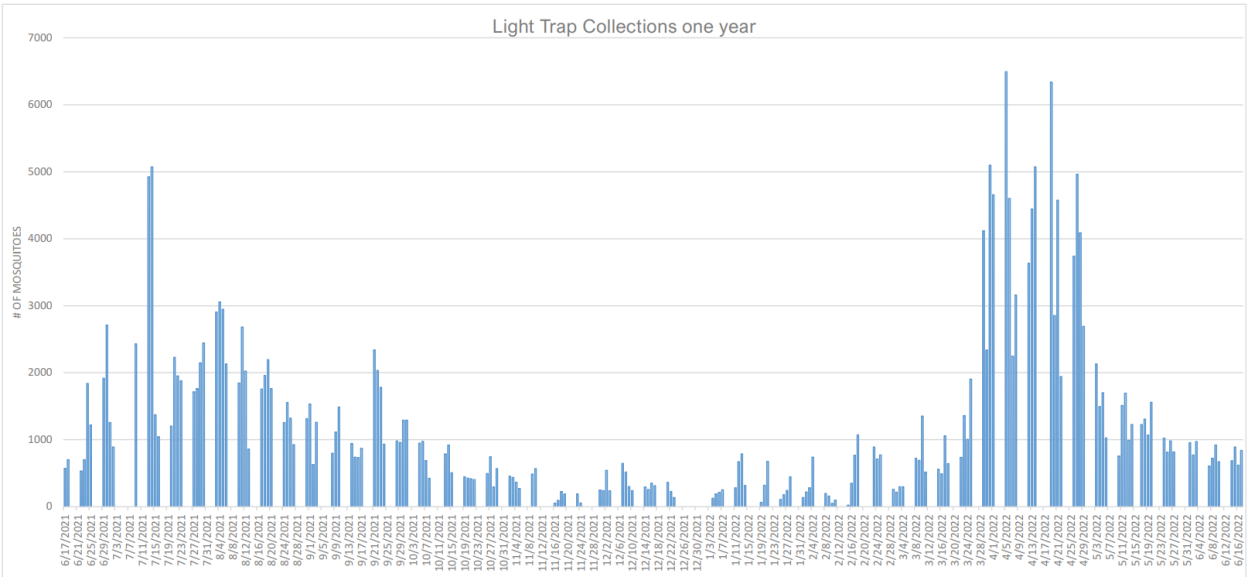
Low mosquito activity since the end of May (Chart below).



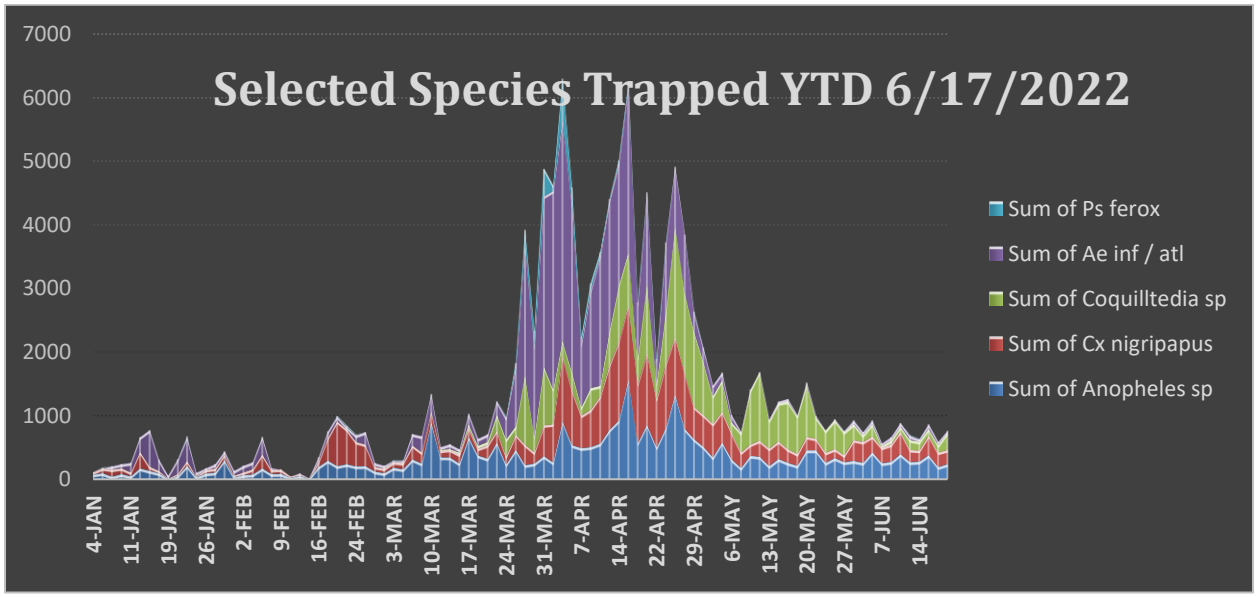
No adulticide treatments this week.

Week of 6/13/2022 Operations Update

Fourth week of low mosquito activity. Second week with no adulticide spraying. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



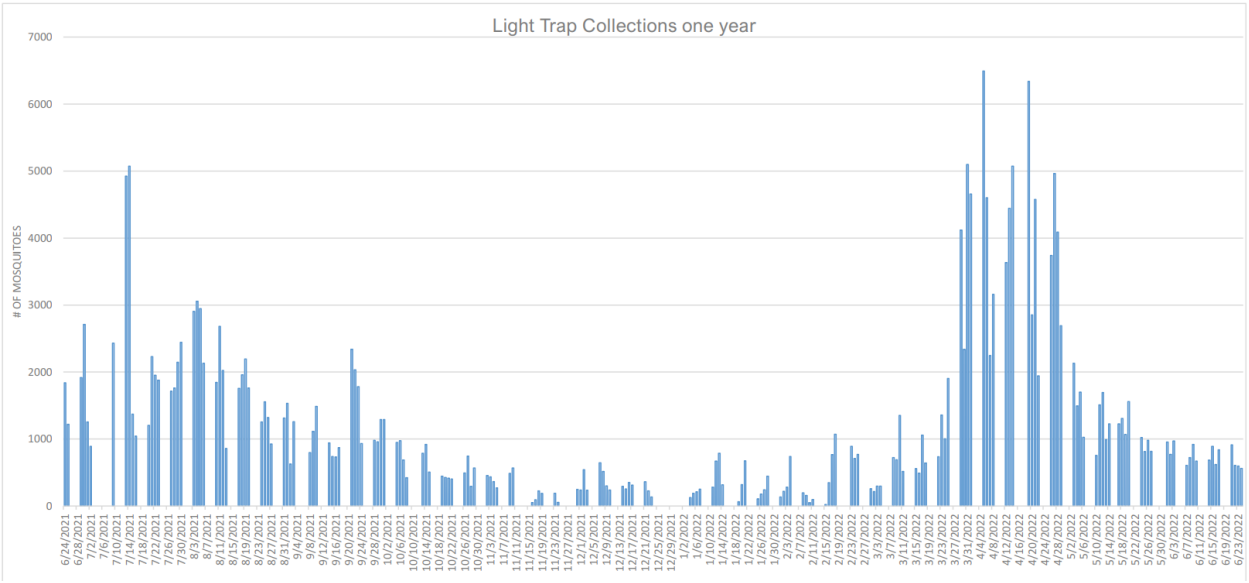
Low mosquito activity since the end of May (Chart below).



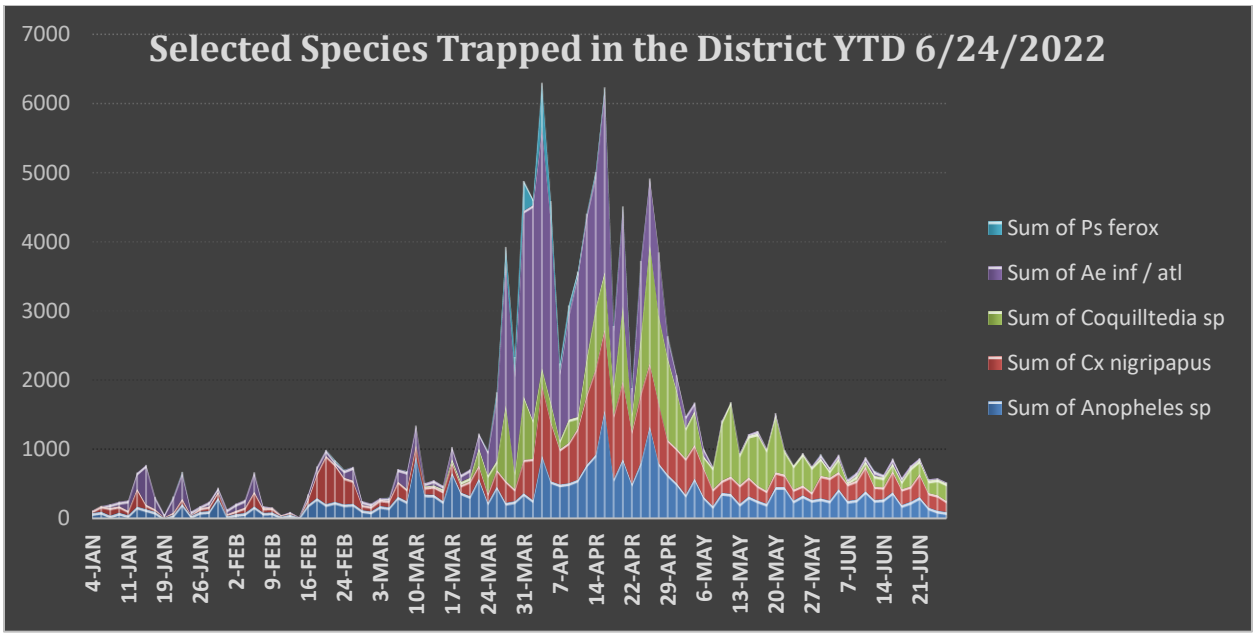
No adulticide treatments this week.

Week of 6/20/2022 Operations Update

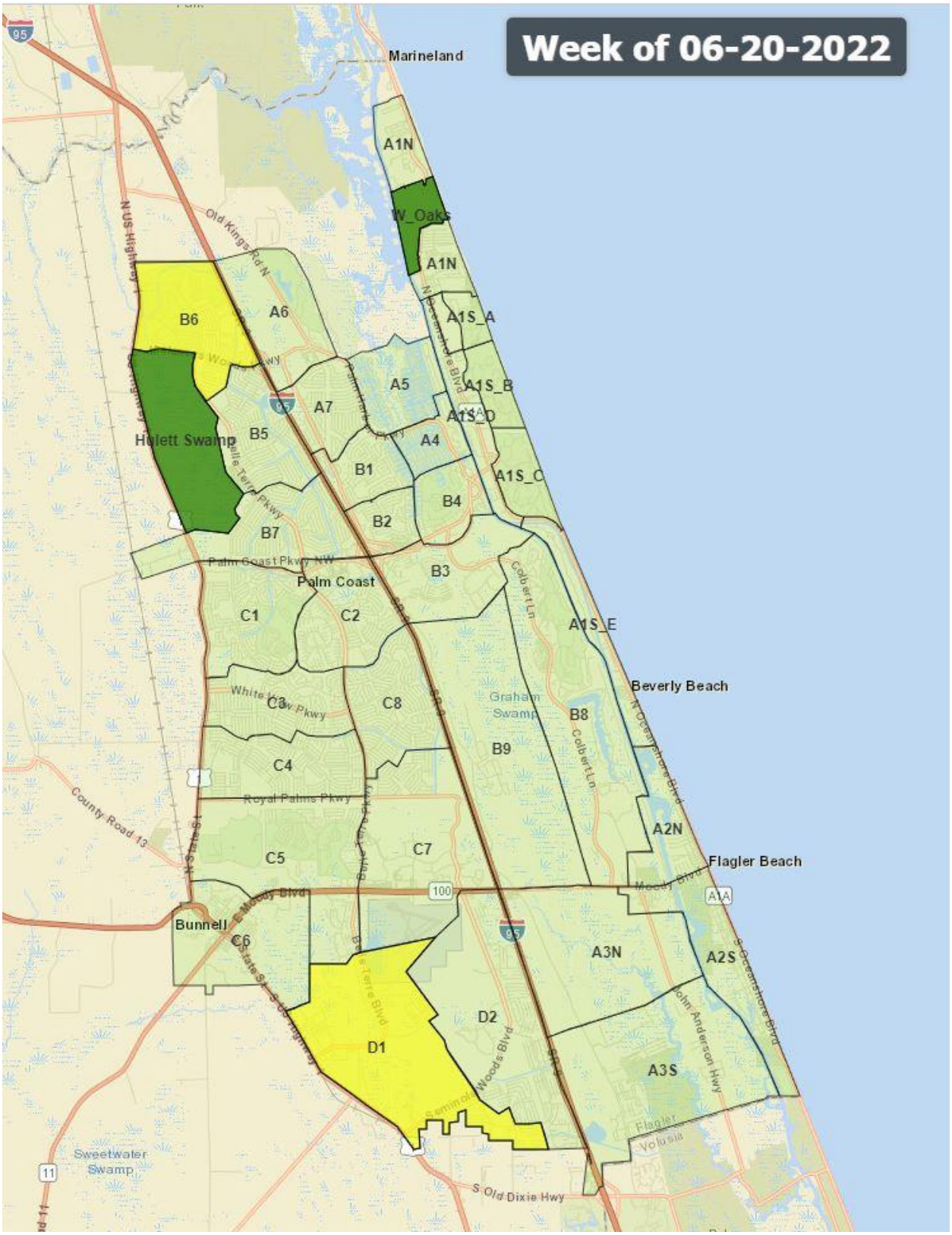
Fifth week of low mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Low mosquito activity since the end of May, five weeks running, and mosquito activity is trending even lower (Chart below). The population of permanent-water mosquito species, meaning the mosquito lays eggs in standing water, have started to decline and flood water species, meaning this type of mosquito lays eggs in dry soil and hatches when it floods, are all but absent from our traps. We are sill seeing some *Coquilletidia perturbans* in the very north and south portions of the District where there is less development and considerable fresh-water swamp habitat.

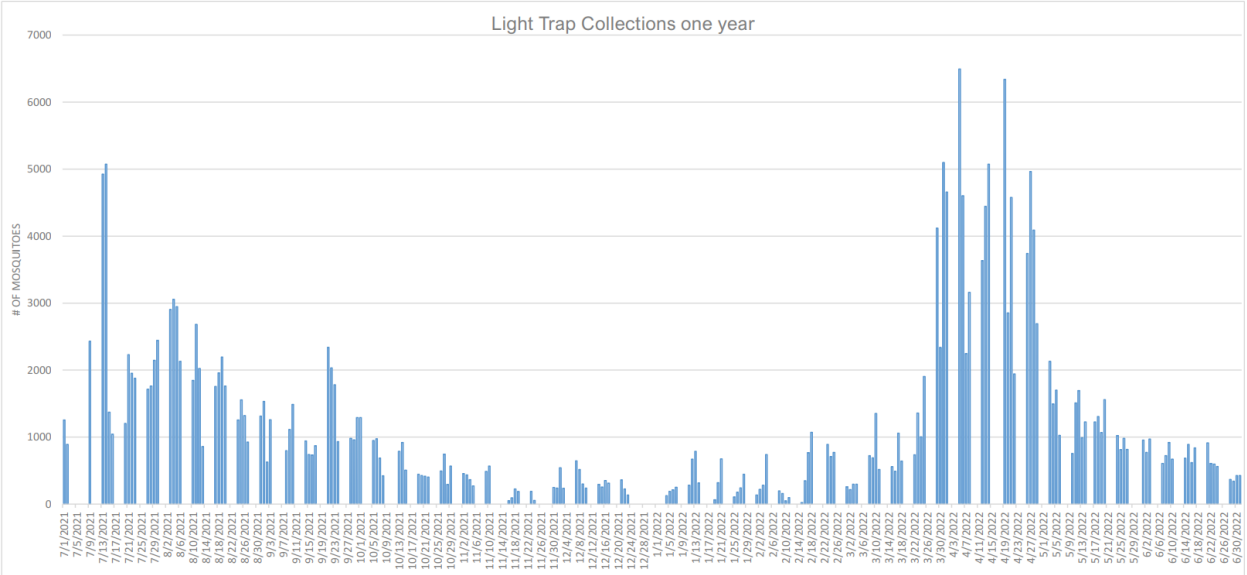


Zones highlighted in yellow were treated by truck this week.

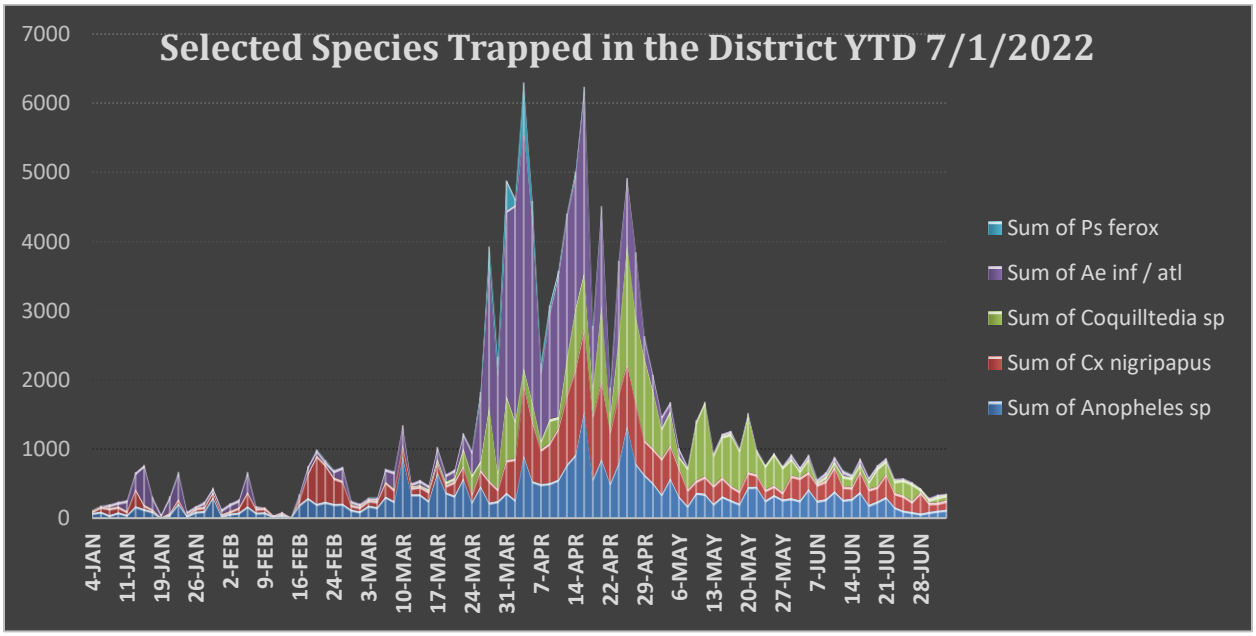


Week of 6/27/2022 Operations Update

Sixth week of low mosquito activity, with an even further dip in mosquito population. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



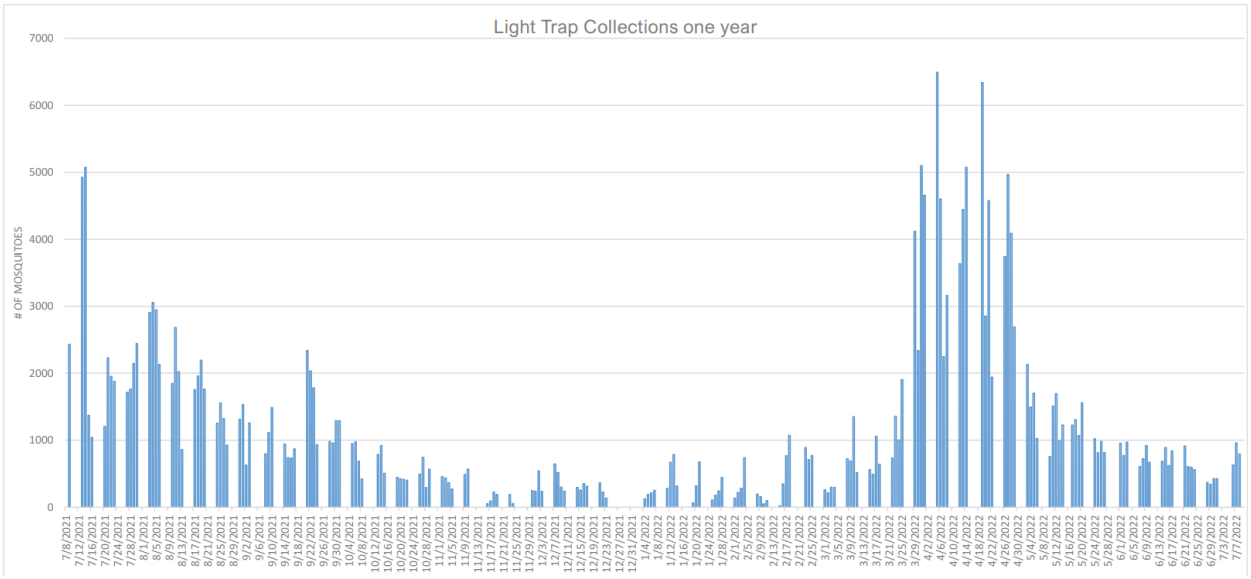
Low mosquito activity since the end of May (Chart below). Flood water mosquito species have all but disappeared from our daily trap totals. Culex nigripalpus, a permanent water mosquito, reproduces in wet low-lying areas, like ditches. The significance of a reduction in this species is that even permanently wet areas are starting to dry up from the lack of precipitation and extreme heat.



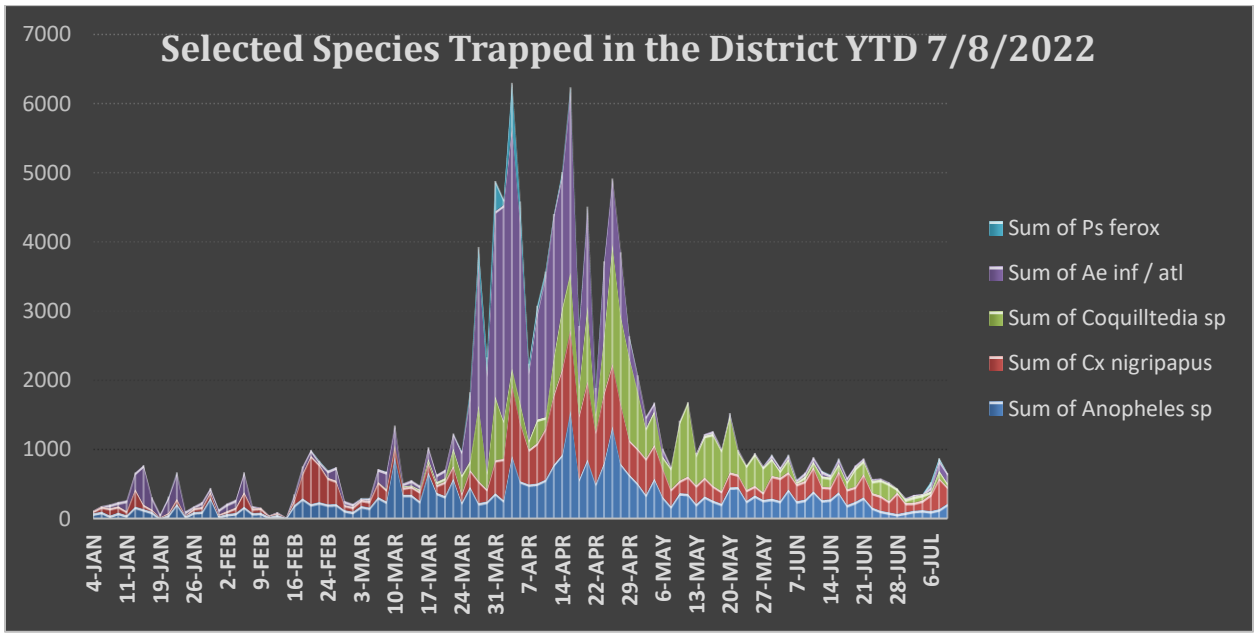
No spraying this week, “You have to have mosquitoes to spray for mosquitoes. It’s the law.”

Week of 7/4/2022 Operations Update

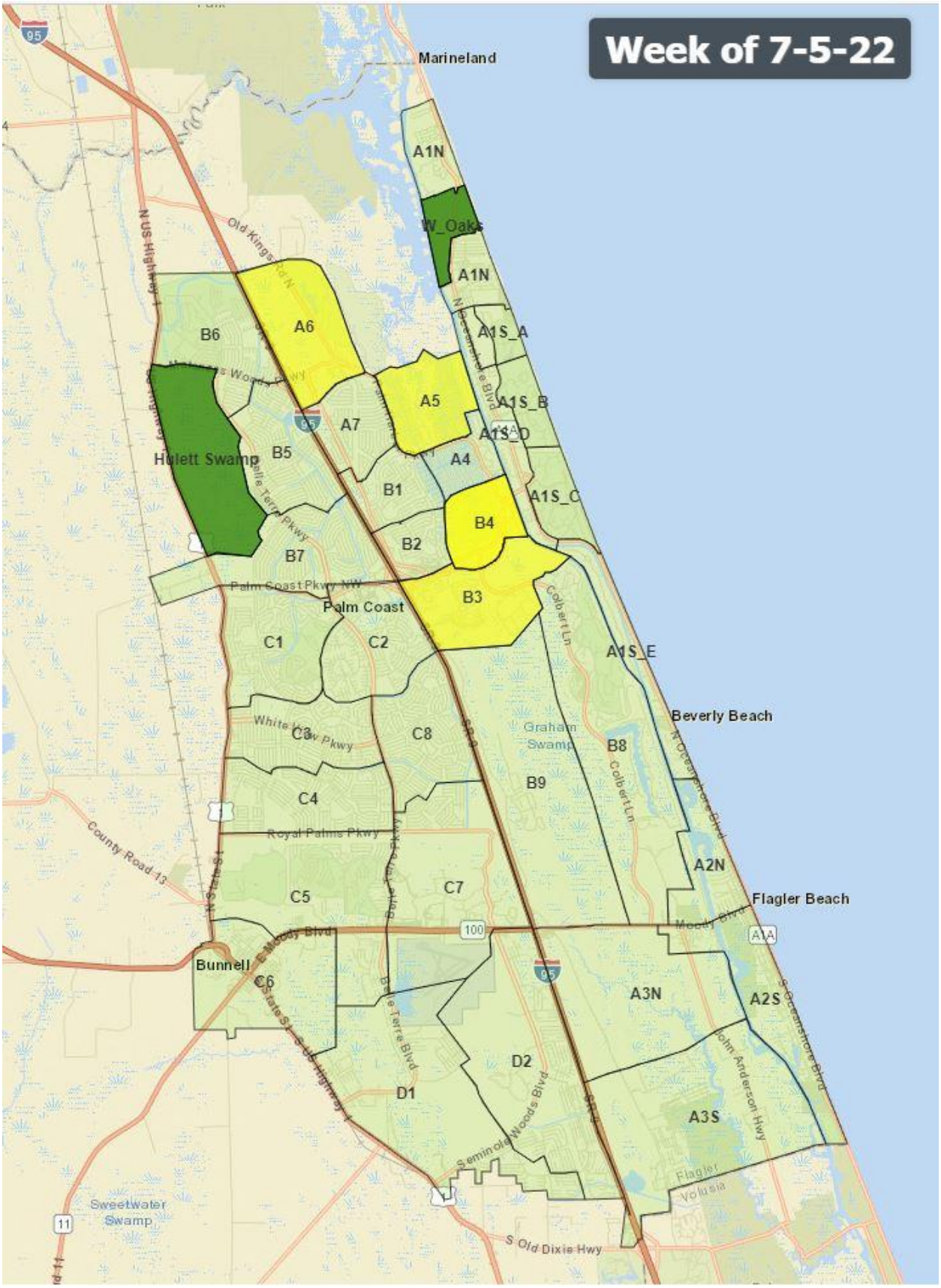
Seventh week of low mosquito activity, but with a marginal increase in mosquito population. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Low mosquito activity since the end of May has predominated until this week when *Culex nigripalpus*, a permanent water species, numbers increased (Chart below). This suggests normally wet low-lying areas are once again holding water after dry down. The flood water species *Aedes infirmatus* has also returned at low levels after all but disappearing from our surveillance traps, only to resurge from the eggs previously laid in the soil once sufficient rain had fallen. These temporarily flooded areas produce vast amounts of aggressive mosquitoes capable of flying up to ten miles in search of a blood meal.

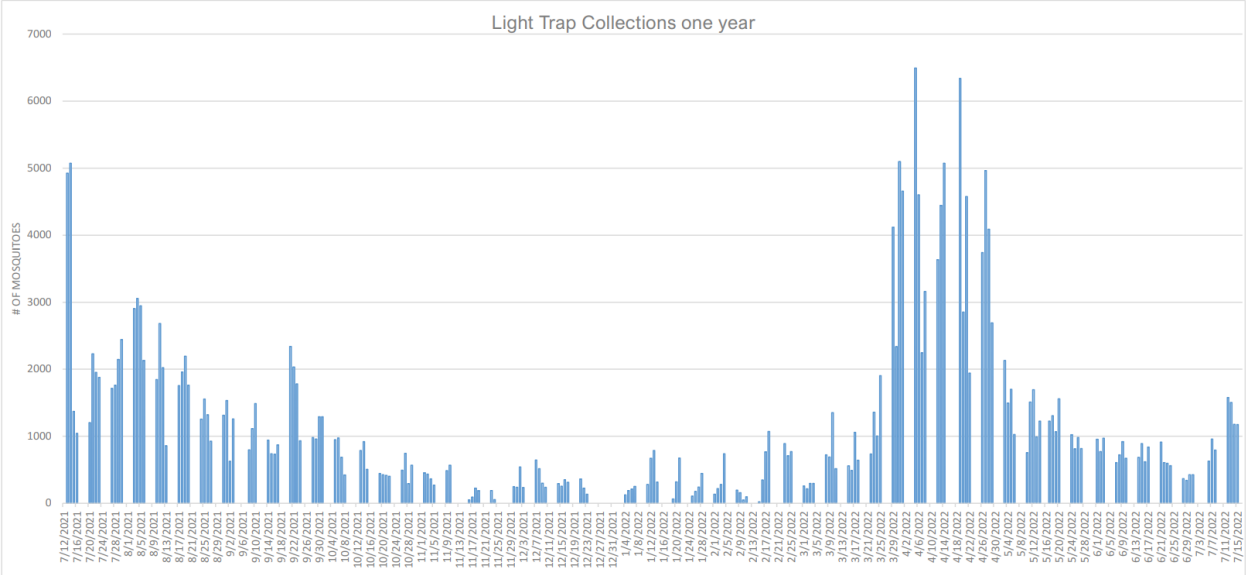


Zones hi-lighted in yellow were sprayed by truck this week.

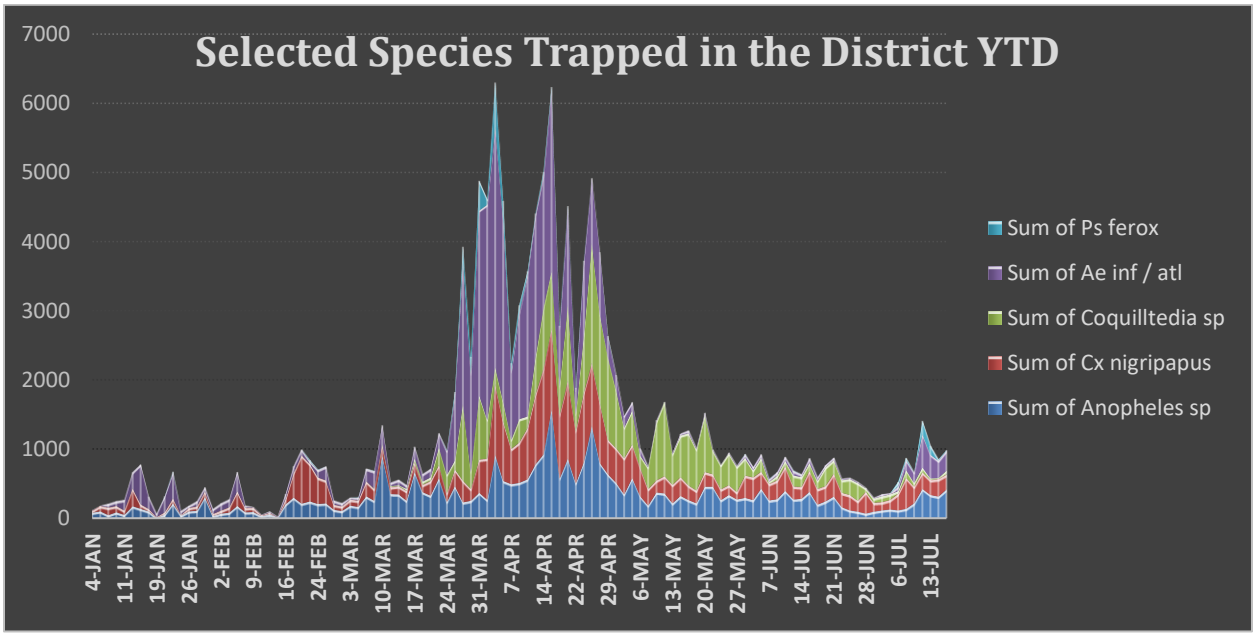


Week of 7/11/2022 Operations Update

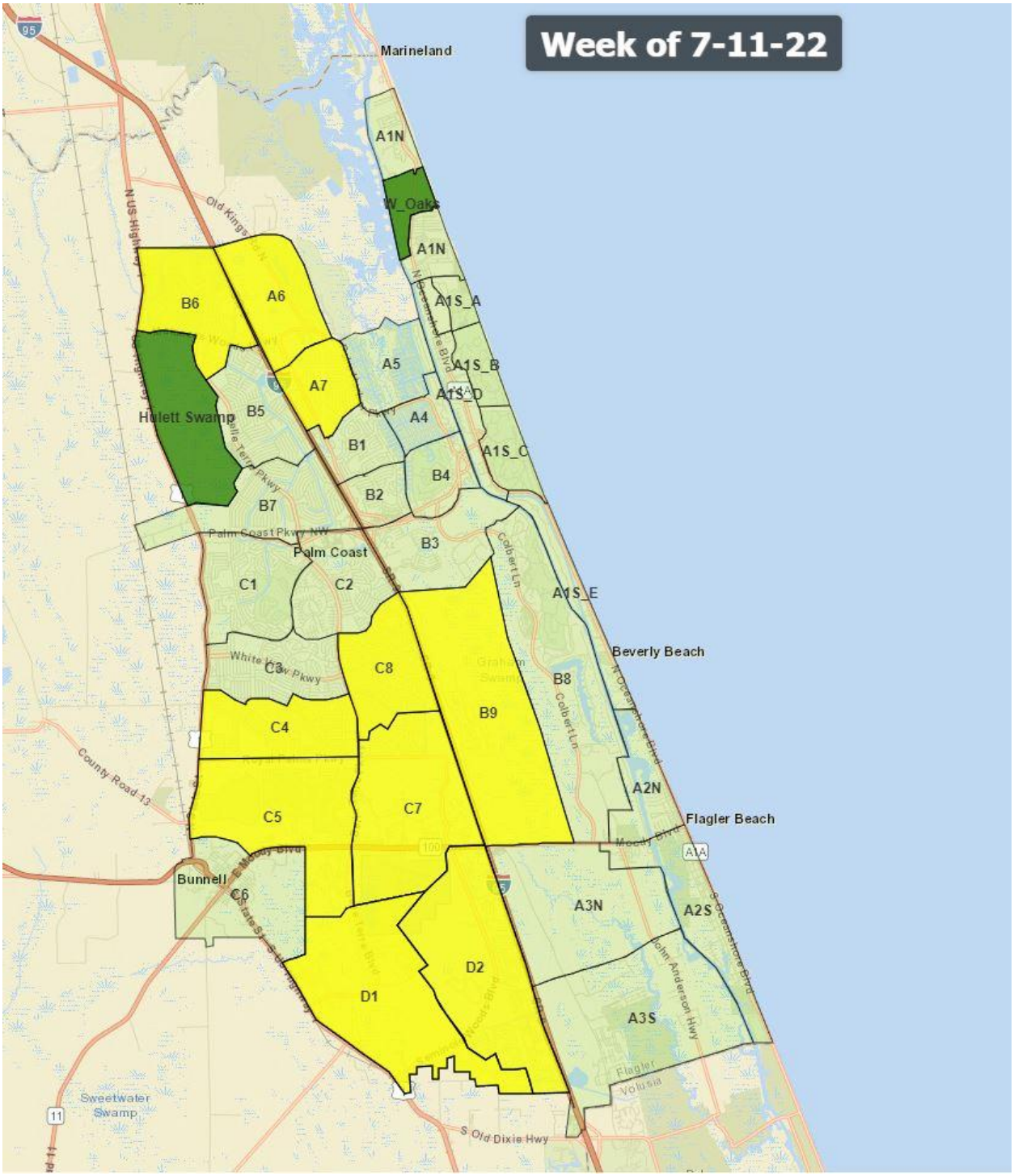
This week saw a substantial presence of flood water species after seven weeks of low mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



A lack of precipitation and high heat have sustained a low level of mosquito activity since the end of May until this week (Chart below). Mosquito activity was focused in the north and the south of the District where there is less development and natural areas are prone to intermittent flooding capable of producing vast quantities of flood water mosquito species that can migrate five to ten miles from breeding sites.

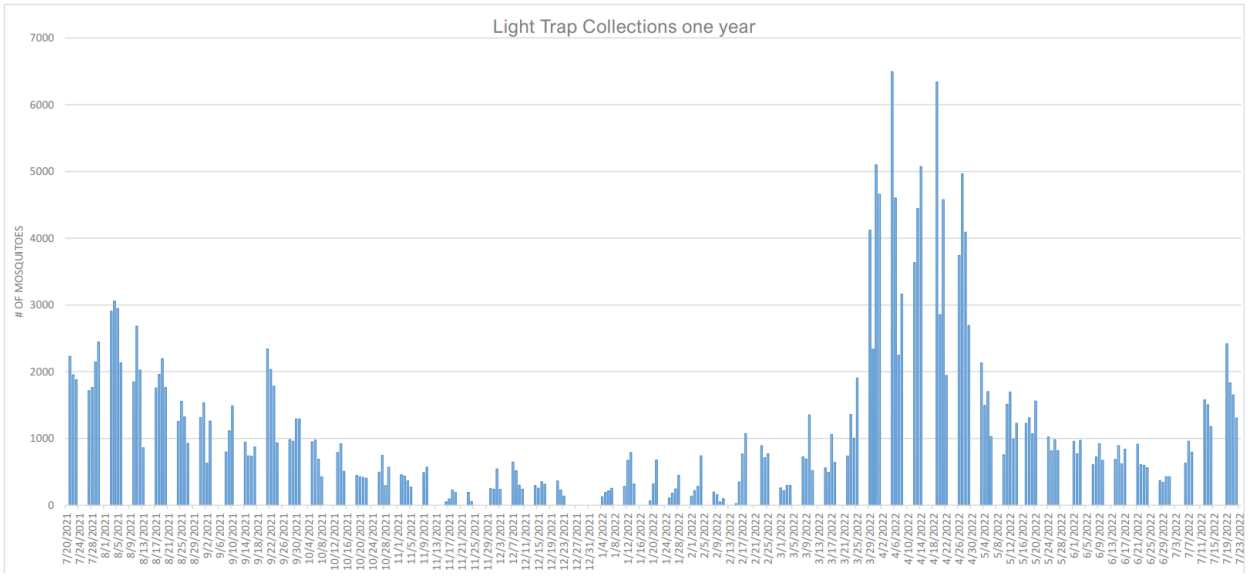


Zones hi-lighted in yellow were sprayed by truck this week.

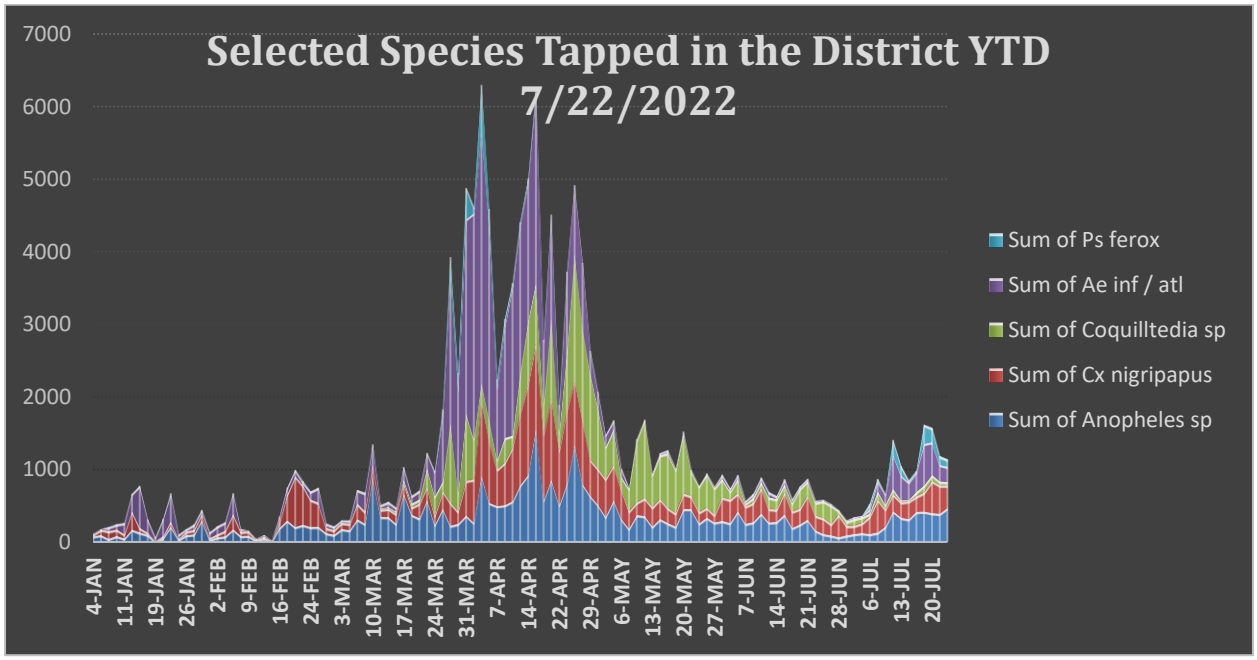


Week of 7/18/2022 Operations Update

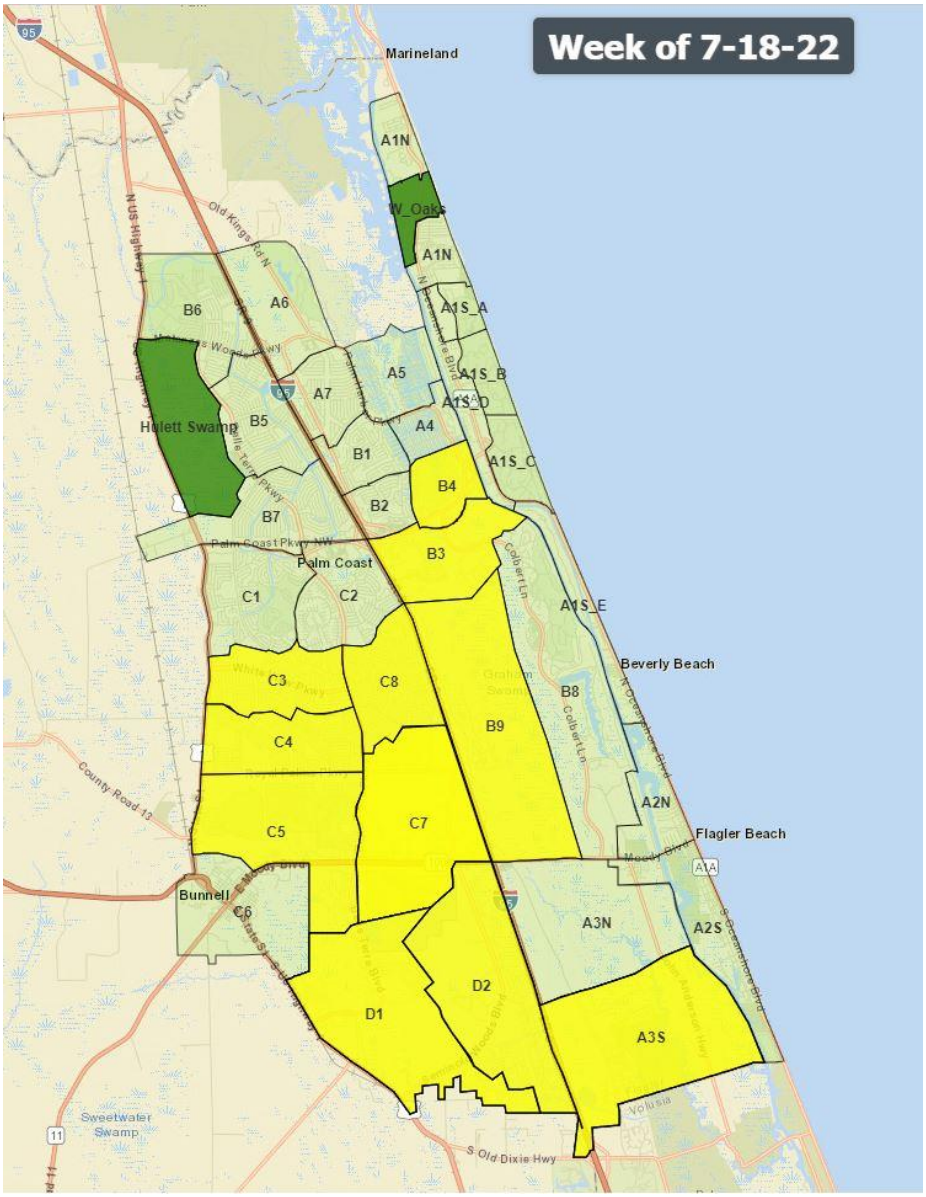
This week was the second week of increased flood water species mosquito activity after seven weeks of low mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



A lack of precipitation and high heat have sustained a low level of mosquito activity since the end of May until the week of 7/11 (Chart below). The permanent water mosquito species *Anopheles spp.* and *Culex nigripalpus* populations have returned to baseline population values as more normal rainfall has occurred. The flood-water species *Aedes infirmatus* and *Psorophora ferox* increased due to rainfall accumulation over the South of the District and near Graham Swamp in the vicinity of Daytona State College.



Zones hi-lighted in yellow were sprayed by truck this week.



The Florida Department of Health in Miami-Dade has issued a mosquito-borne illness advisory for local transmission of Dengue. The Dengue virus cycles back and forth between human and mosquito populations in warmer parts of the world. Local transmission in Florida is uncommon and happens when an infected traveler returns and infects the local population of mosquitoes when the mosquito feeds on the infected traveler. The now infected mosquito can transmit the virus to other humans that have not traveled and then you have “local transmission.” Press release below.

While there are 48 species of mosquitoes in Flagler County, only two breed in containers around your home and both are competent vectors of Dengue. Keeping your yard clear of containers that hold water is key to eliminating the species of mosquitoes that transmit Dengue. Bromeliads are a popular ornamental plant but they hold water and breed these mosquitoes as well. Removal is the best option for control.

July 18, 2022

HEALTH OFFICIALS ISSUE MOSQUITO-BORNE ILLNESS ADVISORY FOLLOWING CONFIRMATION OF ONE DENGUE CASE

Contact:
Communications Office
786-336-1276

MIAMI – The Florida Department of Health in Miami-Dade County (DOH-Miami-Dade) is under a mosquito-borne illness advisory following the confirmation of an identified case of dengue in a Miami-Dade resident. This is the first local case of dengue infection in 2022.

Dengue is a virus spread through mosquito bites by *Aedes* mosquitoes which also spread the chikungunya and Zika virus. Most people infected with dengue have mild or no symptoms. Those that do develop symptoms typically recover after about one week.

DOH-Miami-Dade encourages the following mosquito protection efforts to stop mosquitoes from multiplying and to protect your skin by remembering to "**Drain and Cover**."

DRAIN standing water –

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flowerpots or any other containers where sprinkler or rainwater has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

COVER skin –

- Clothing - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who work in areas where mosquitoes are present.
- Repellent - Apply mosquito repellent to bare skin and clothing, but not under clothing.
    - Always read label directions carefully for the approved usage before you apply a repellent – **Some repellents are not suitable for children**.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, para-menthane-diol, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

COVER doors and windows –

- Repair broken screening on windows, doors, porches, and patios to keep mosquitoes out of your house.

Additional Tips on Repellent Use

- In protecting children, read label instructions to be sure the repellent is age-appropriate. According to the Centers for Disease Control and Prevention (CDC), mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of three years. DEET is not recommended on children younger than two months old.
- Avoid applying repellents to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing.
- If additional protection is necessary, apply a permethrin repellent directly to your clothing. Again, always follow the manufacturer's directions.

For more information on what repellent is right for you, consider using the Environmental Protection Agency's search tool to help you choose skin-applied repellent products: http://cfpub.epa.gov/oppref/insect/#searchform.

Symptoms

The common symptoms of dengue are **fever** and **one or more of the following symptoms**: headache; eye pain (typically behind the eyes); muscle, joint, or bone pain; rash; nausea and vomiting; or unusual bleeding (nose or gum bleed, small red spots under the skin, or unusual bruising). Severe dengue can occur resulting in shock, internal bleeding, and death. If you or a family member develop the mentioned symptoms, visit your health care provider or local clinic.

The Florida Department of Health (DOH) continues to conduct statewide surveillance for mosquito-borne illnesses, including West Nile virus infections, Eastern equine encephalitis, St. Louis encephalitis, malaria, chikungunya, and dengue. Residents of Florida are encouraged to report dead birds via the Florida Fish and Wildlife Conservation Commission's site - http://legacy.myfwc.com/bird/default.asp. For more information, visit DOH's website at http://www.floridahealth.gov/%5C/diseases-and-conditions/mosquito-borne-diseases/index.html or contact DOH-Miami-Dade.

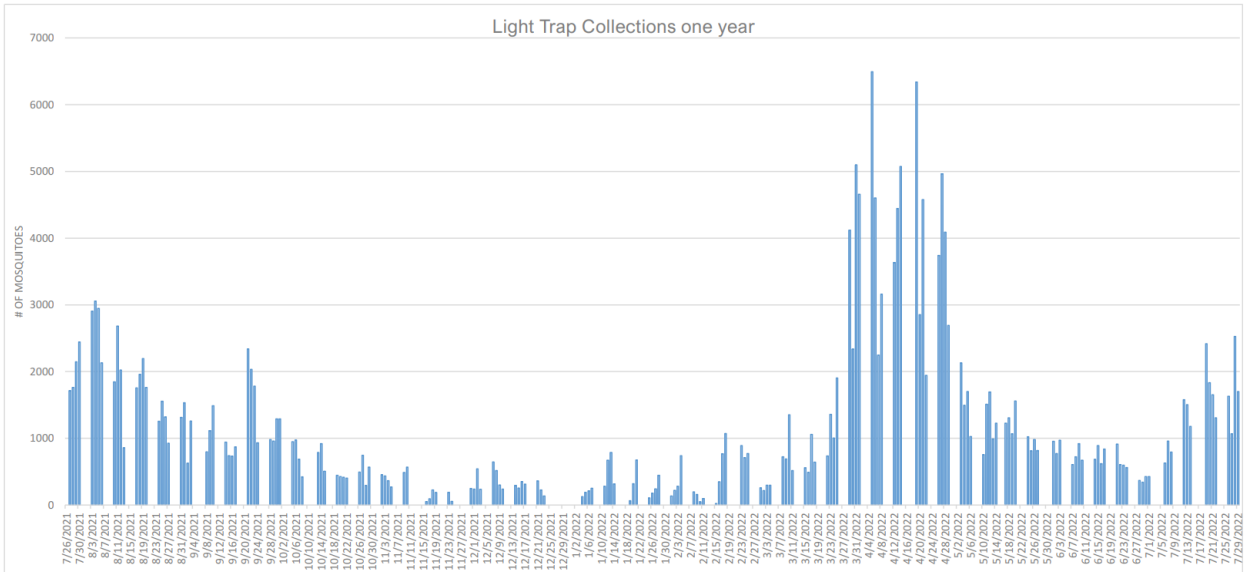
About the Florida Department of Health

The department works to protect, promote and improve the health of all people in Florida through integrated state, county and community efforts.

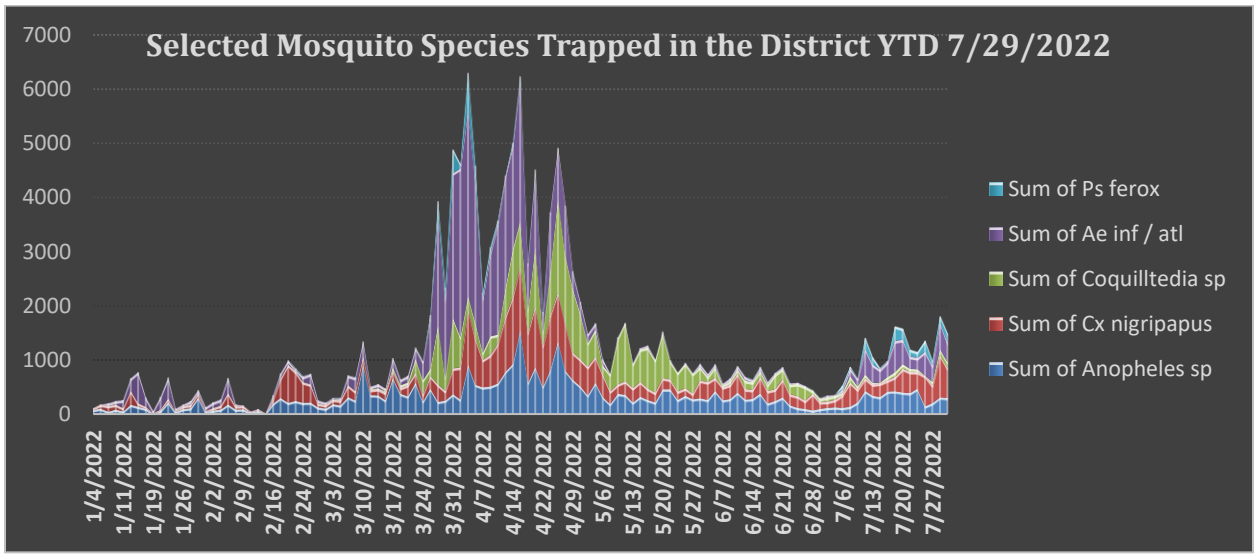
Follow us on Twitter at @HealthyFla and on Facebook. For more information about the Florida Department of Health please visit www.FloridaHealth.gov.

Week of 7/25/2022 Operations Update

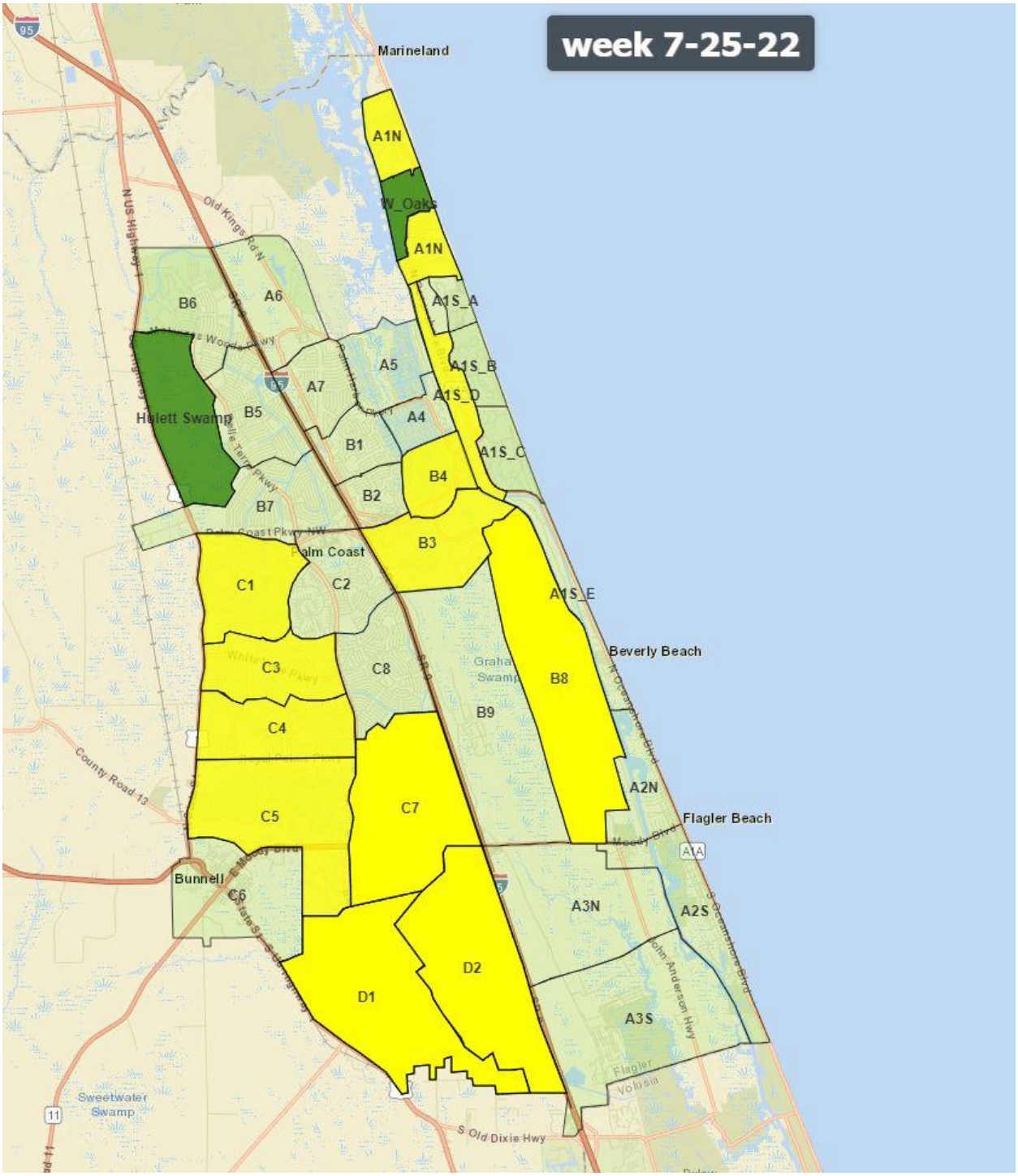
This week was the third week of only moderate flood water species activity after seven weeks of low mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Daily mosquito traps have shown a steady low-level influx of two species of flood water mosquitoes *Aedes infirmatus* and *Psorophora ferox* over the past few weeks (Chart below). The typical surge in mosquito populations following heavy rains has not occurred for the month of July. The unusual lack of a surge in population of flood water mosquitoes migrating into populated areas may be the result of scattered showers followed by high heat effectively limiting the ability of these species to reproduce by reducing the length of time standing water remains.



Zones hi-lighted in yellow were sprayed by truck this week.

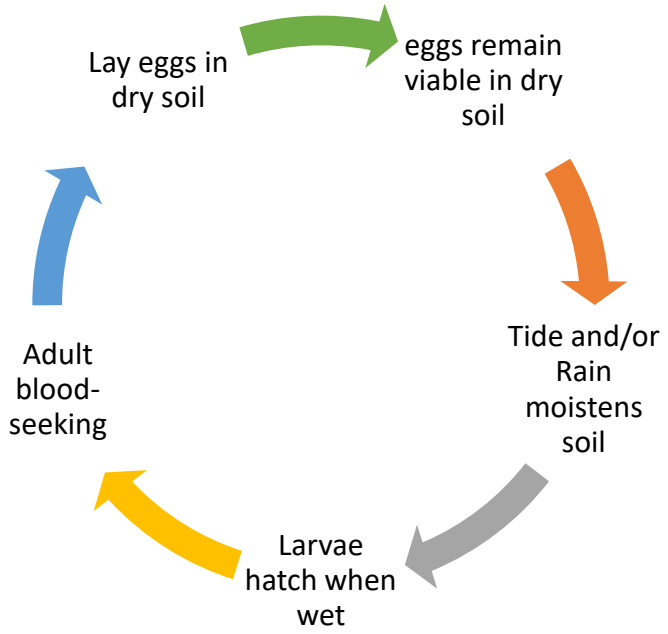


Week of 7/25/2022 Operations Update

Rain Analysis Supplemental

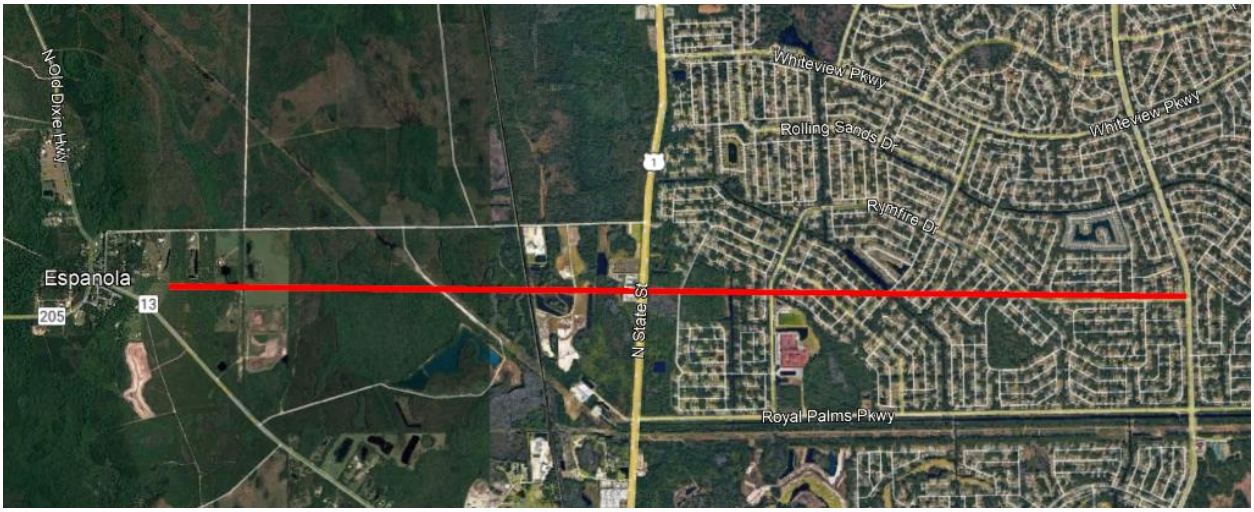
Background

Alternating wet and dry cycles are ideal for the production of floodwater mosquitoes which hatch in flooded waters and lay their eggs after having blood-fed in dry soil of previously flooded sites in order to repeat the process. Species of the Aedes and Psorophora genuses reproduce in this way and typically have a flight range of 5 – 10 miles. This translates into ample breeding areas outisde the District, and some in areas within the District that are less developed, within the flight range of these mosquitoes which can then migrate into the Ditrict to blood feed on humans. The life-cycle of floodwater mosquitoes is depicted below.



The ebb and flow of standing water produced by rainfall and tides (for saltmarsh mosquitoes) prevents predation by fish and other aquatic organisms while mosquitoes are in the immature or larval stage. Because mosquitoes can reproduce prolifically, natural predators such as bats, purple martins, dragon flies, etc. cannot consume enough of these pests to overcome the mosquitoes irruptive growth in population.

The District currently occupies one-fifth of the land areas of Flagler County with most of the area outside the District capable of producing vast quantities of floodwater mosquitoes. Mosquitoes born from as far away as Espanola can migrate five miles to eastward and make it to Belle Terre Boulevard as seen in the map below, red line is 5 miles.



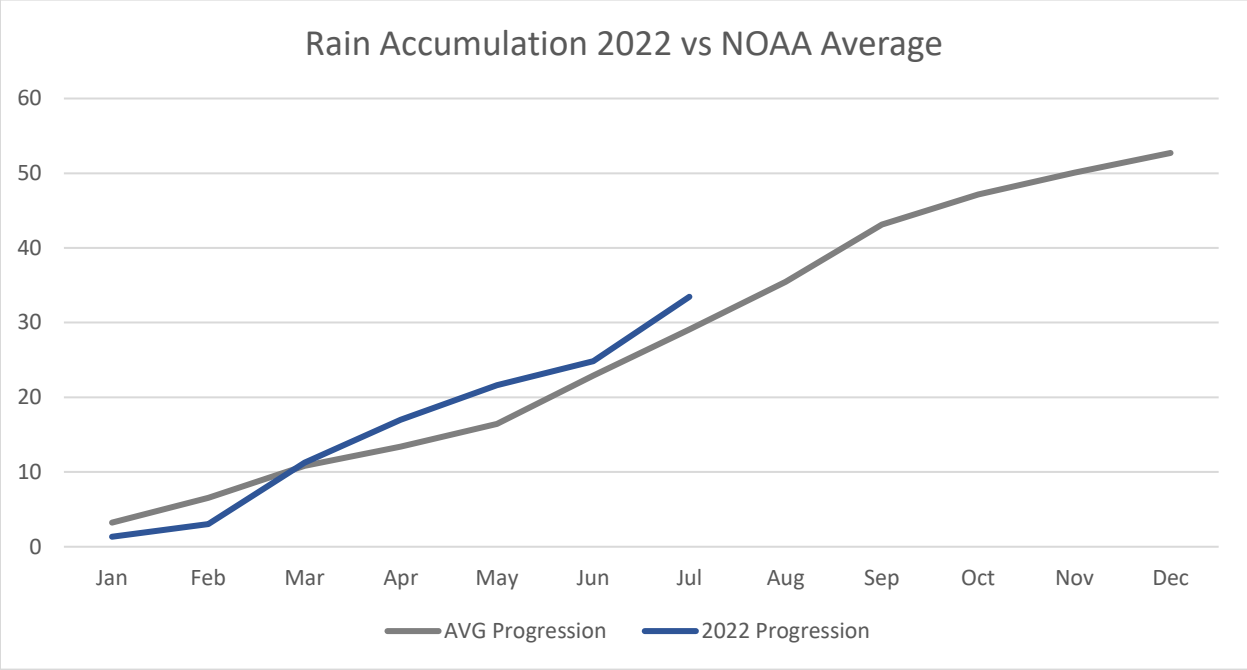
To counter the intrusion of these far flying mosquitoes the District monitors a network of mosquito traps year-round and applies pesticides when the mosquito population exceeds the baseline as required by law for the application of pesticides. Threfore, spraying cannot be scheduled on a recurring basis because current data to provide justification for control measures is required. In other words, you have to have mosquitoes before you can spray for mosquitoes.This part of our operations remain reactive as opposed to our larvicide efforts for saltmarsh mosquitoes which are proactive.

Monitoring rainfall, conducting landing rate counts, and maintaining daily mosquito traps allows the Dsitrict to respond to mosquito population increases rapidly and suppress the population down to baseline values when proacitve measures are not feasible.

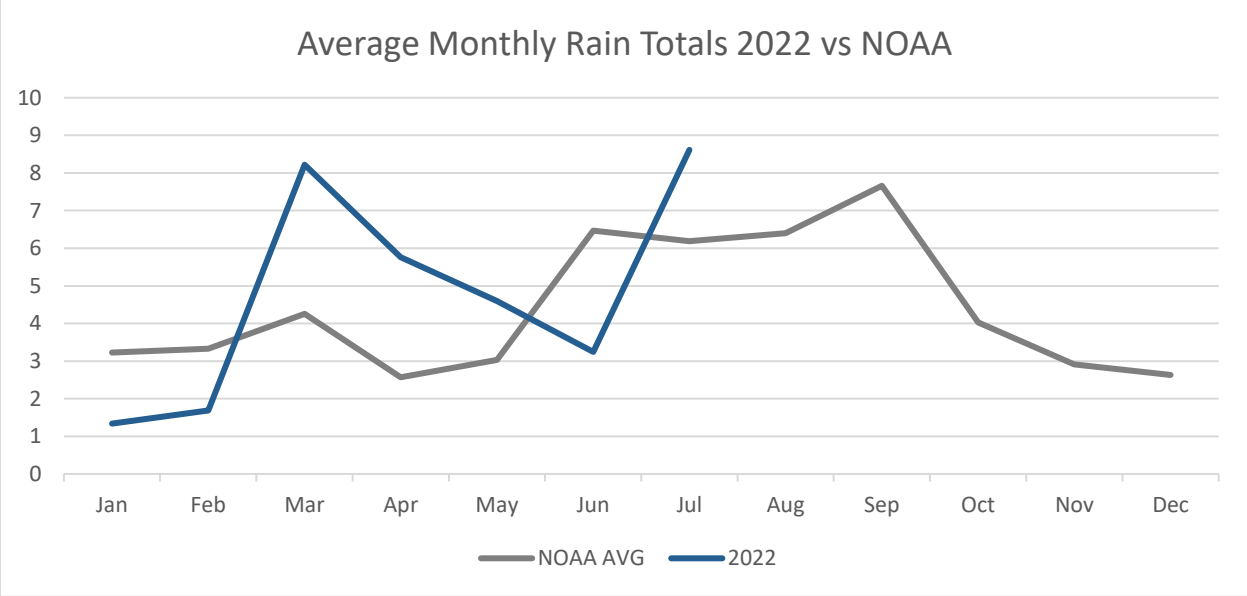
Rain Analysis

To gauge how the monthly rainfall totals compare to a normal year, we make use of the 1981-2010 Climate Normals, which are NOAA's latest three-decade averages of climatological variables. Found here http://www.ncdc.noaa.gov/cdo-web/datatools/normals. Data was utilized for the Palm Coast 6 NE station.

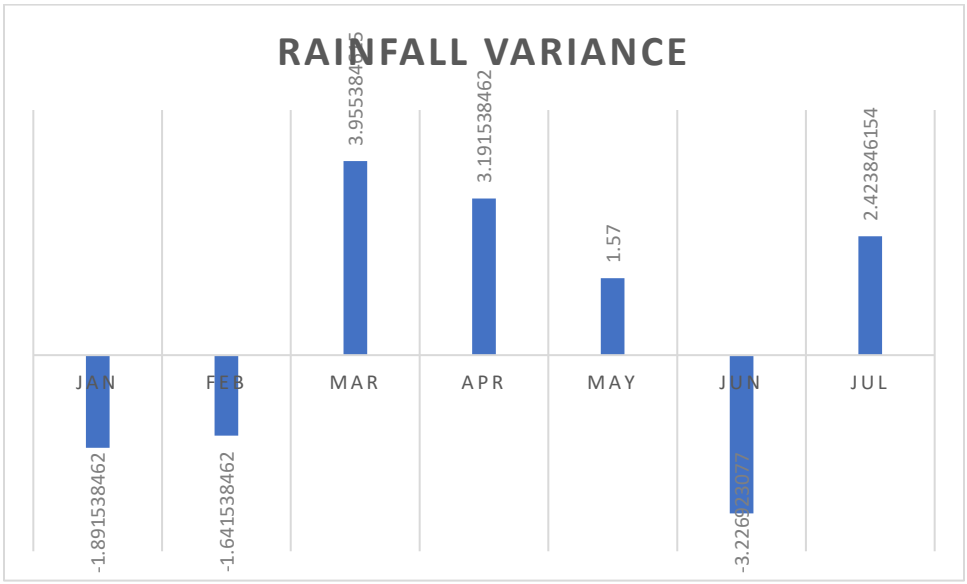
Plotting the normal rainfall accumulation from NOAA against the average rainfall accumulation recorded in the District, you can see 2022 is roughly on track to be close to a normal year (graph below).



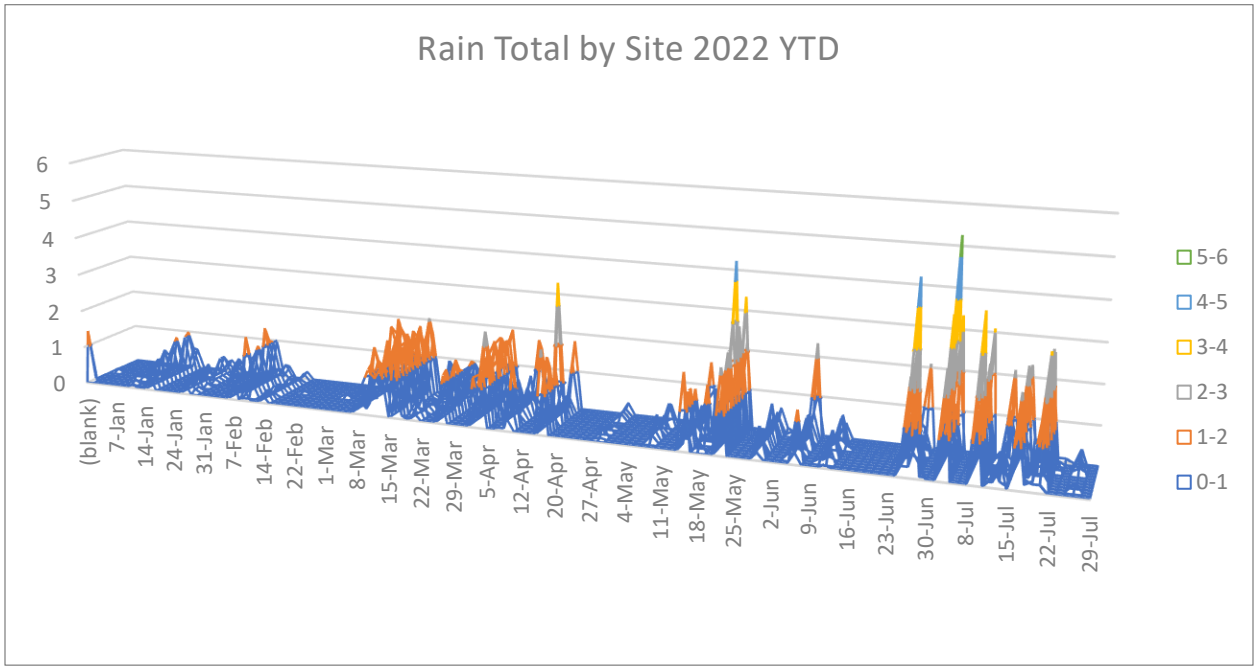
However, when you compare the data on a month-by-month basis, a very different situation is revealed with rainfall amounts varying widely this year from the normal year (graph below).



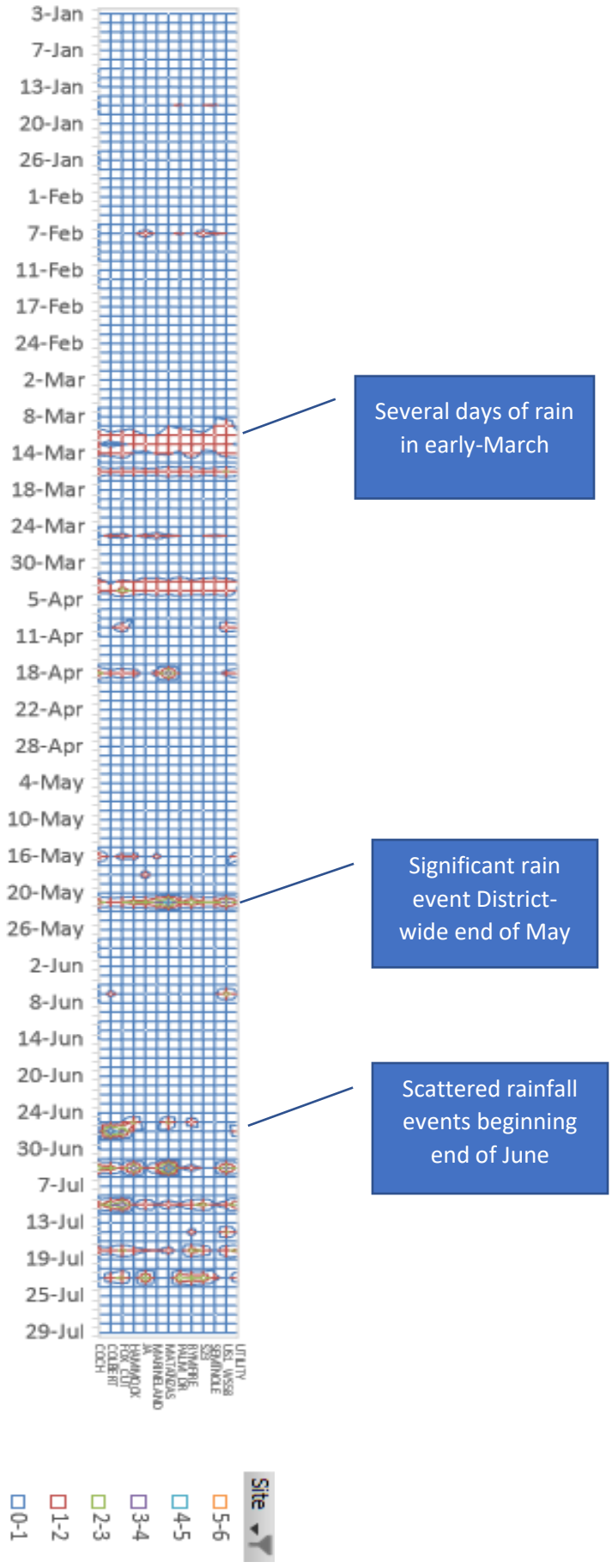
The variance from a typical rainfall pattern has alternating deficit and surplus, which makes the yearly accumulation appear normal (graph below).



Looking at the rainfall data by date and location shows the rainfall is occurring in distinct events rather than spread throughout the month as is typically the case in subtropical Florida (graph below).

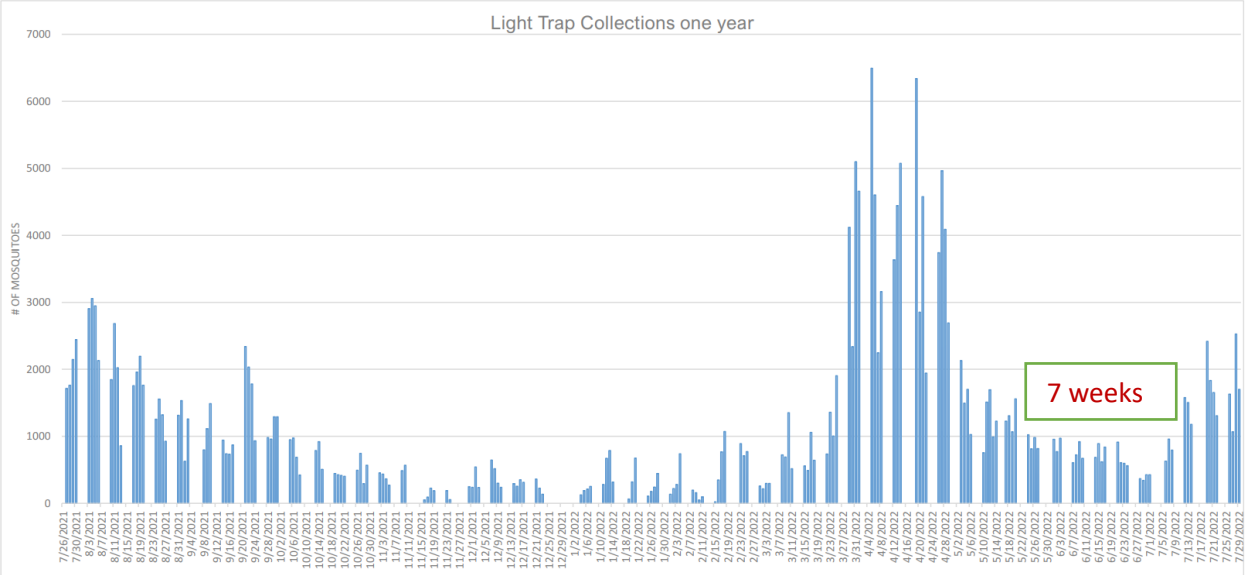


There were several days of rainfall in early to mid-March. A significant District-wide rain event occurred mid-May. There were two extended dry periods from Mid-April to Mid-May and again end of May to End of June. Scattered rainfall events began at the end of June (graph below).

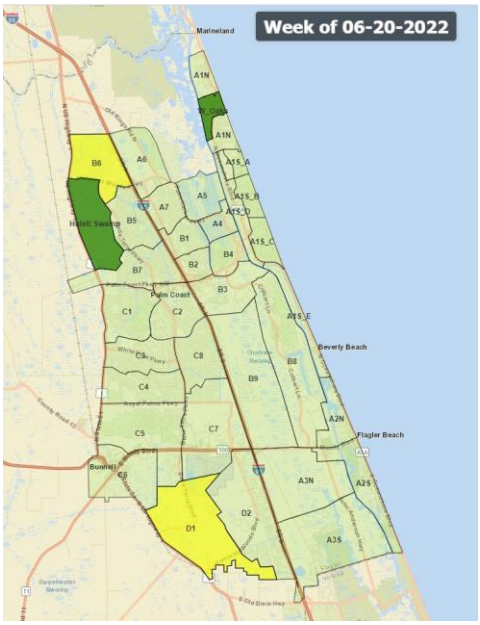

3-Jan
7-Jan
13-Jan
20-Jan
26-Jan
1-Feb
7-Feb
11-Feb
17-Feb
24-Feb
2-Mar
8-Mar
14-Mar
18-Mar
24-Mar
30-Mar
5-Apr
11-Apr
18-Apr
22-Apr
28-Apr
4-May
10-May
16-May
20-May
26-May
2-Jun
8-Jun
14-Jun
20-Jun
24-Jun
30-Jun
7-Jul
13-Jul
19-Jul
25-Jul
29-Jul
Several days of rain in early-March
Significant rain event District-wide end of May
Scattered rainfall events beginning end of June
0-1
1-2
2-3
3-4
4-5
5-6
Site

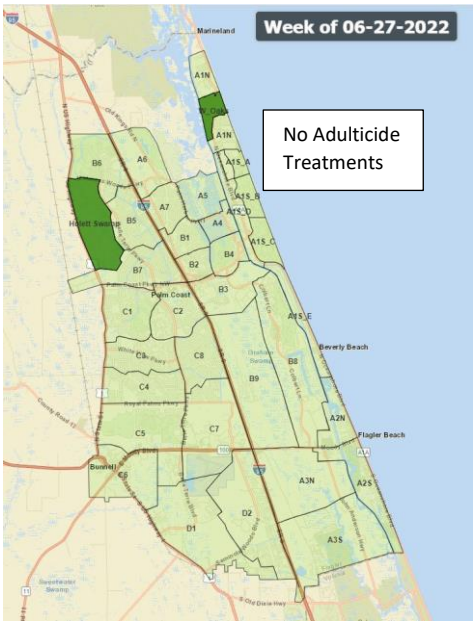
Mosquito Activity

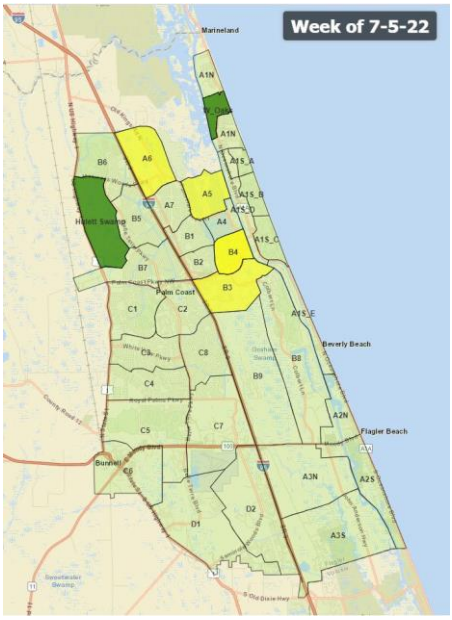
After a seven week period of low mosquito activity from Late-May until Early-July Mosquito populations increased to moderate levels the remainder of July (see total mosquito population chart below).



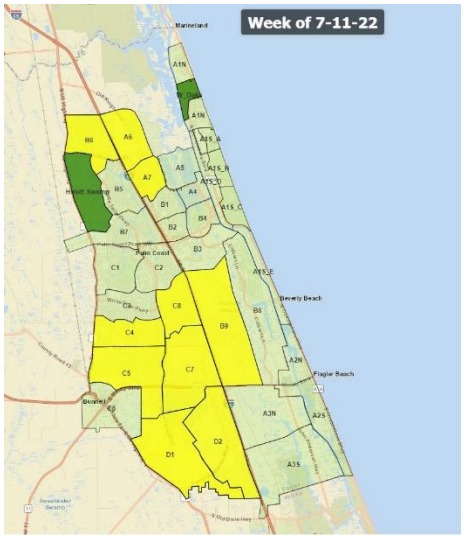
The last two weeks of June and into the first week of July limited truck spraying was conducted (see weekly adulticide spray maps below).

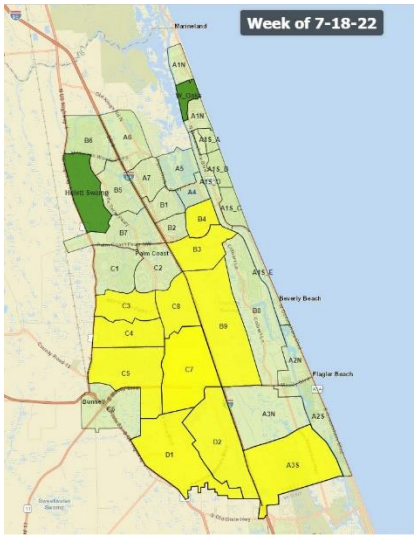


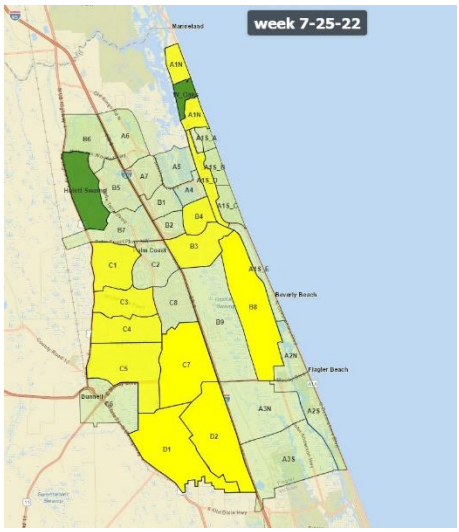




As compared to moderate mosquito activity the rest of July (see weekly adulticide spray maps below).

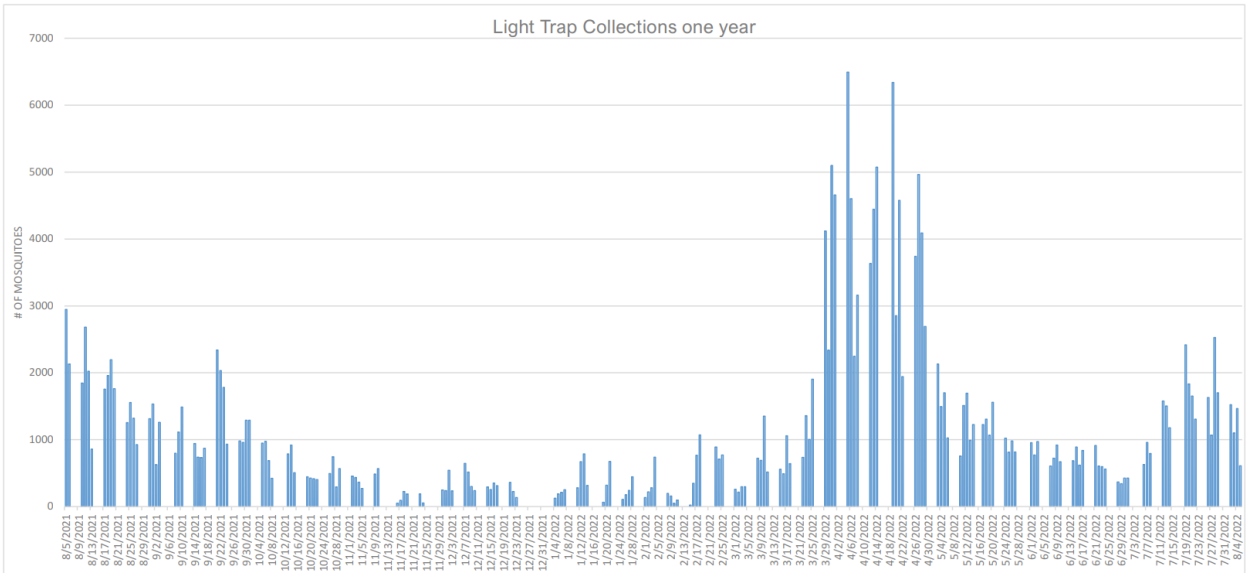




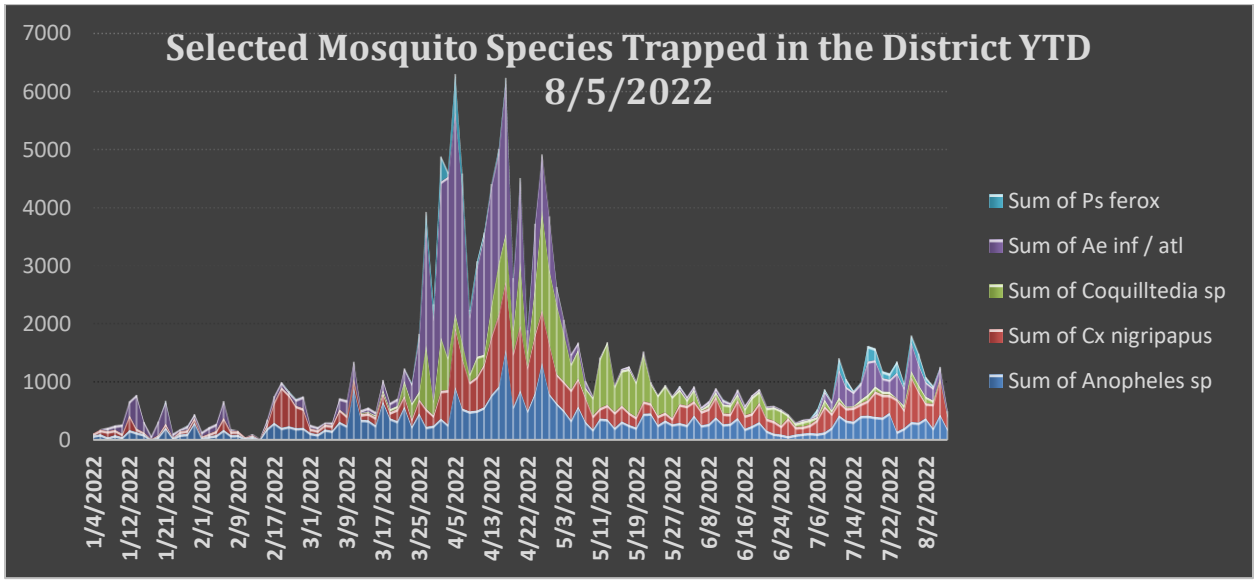


Week of 8/1/2022 Operations Update

Floodwater species populations decreased significantly by the end of the week. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).

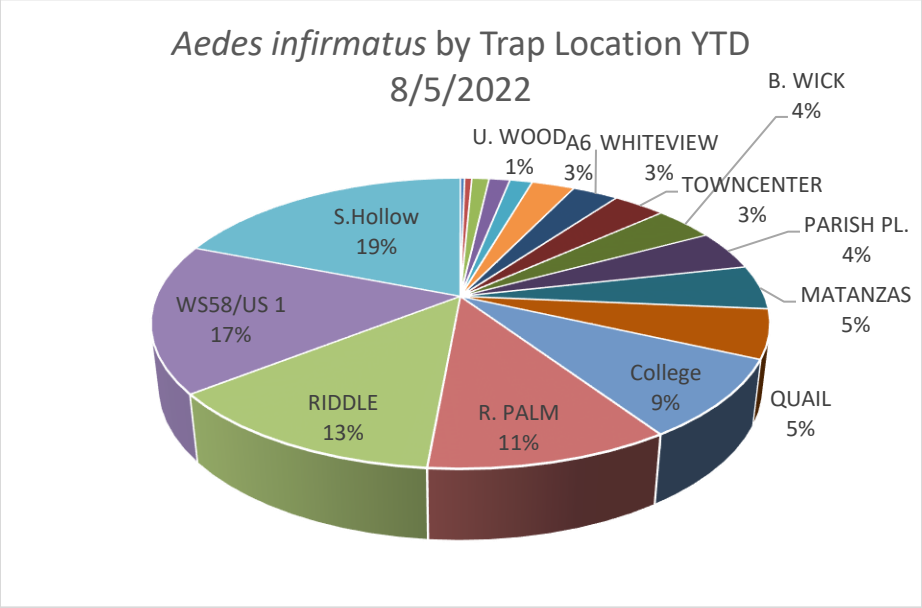


Floodwater mosquito species all but disappeared by the end of the week (Chart below). To recapitulate from last week, the typical surge in mosquito populations following heavy rains has not occurred for the month of July. The unusual lack of a surge in population of flood water mosquitoes migrating into populated areas may be the result of scattered showers followed by high heat effectively limiting the ability of these species to reproduce by reducing the length of time standing water remains.

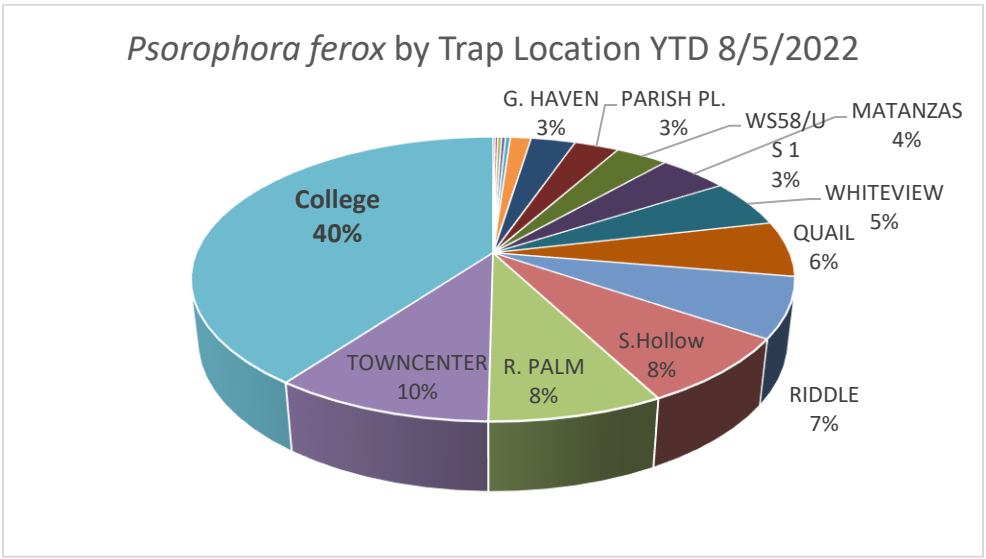


So far this season we have mostly seen only two species of floodwater mosquitoes, *Aedes infirmatus* and *Psorophora ferox.* Floodwater mosquitoes can fly 5-10 miles in search of a bloodmeal and are more aggressive biters than permanent water species like *Culex spp*. and *Anopheles spp*. that primarily feed on birds, and do not migrate far from the swamps they inhabit and have typical flight range of under a mile.

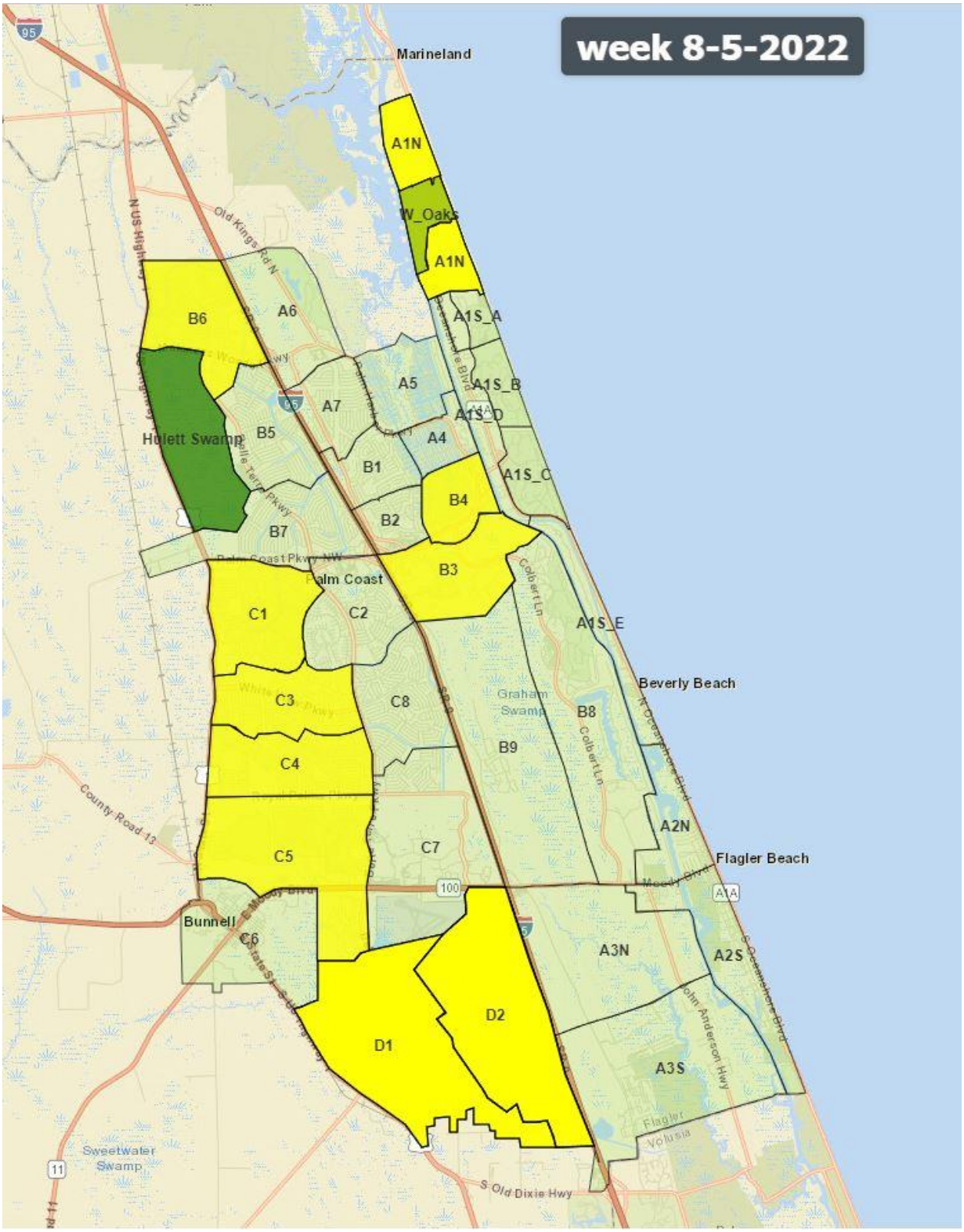
While we make the general distinction between floodwater and permanent water species, there are differences among the species that comprise each. *Aedes infirmatus* is most abundant in the south and west of District, specifically west of US 1 and south of Royal Palms Parkway. The pie chart below shows the percentage of this species caught by location.



Psorophora ferox lays it's eggs in the dry soil in more densely canopied areas with steeper slopes, perferring a longer incubation period, requiring the floodwater to remain for longer periods. In the chart below you can see the distribution is different than the above chart.

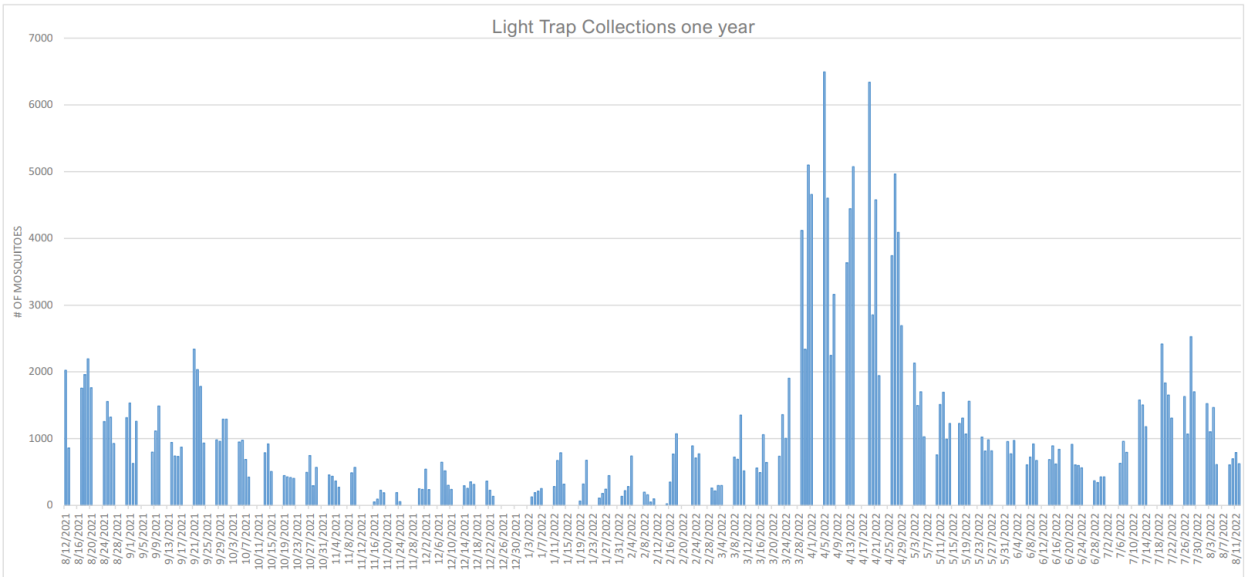


Zones hi-lighted in yellow were sprayed by truck this week.

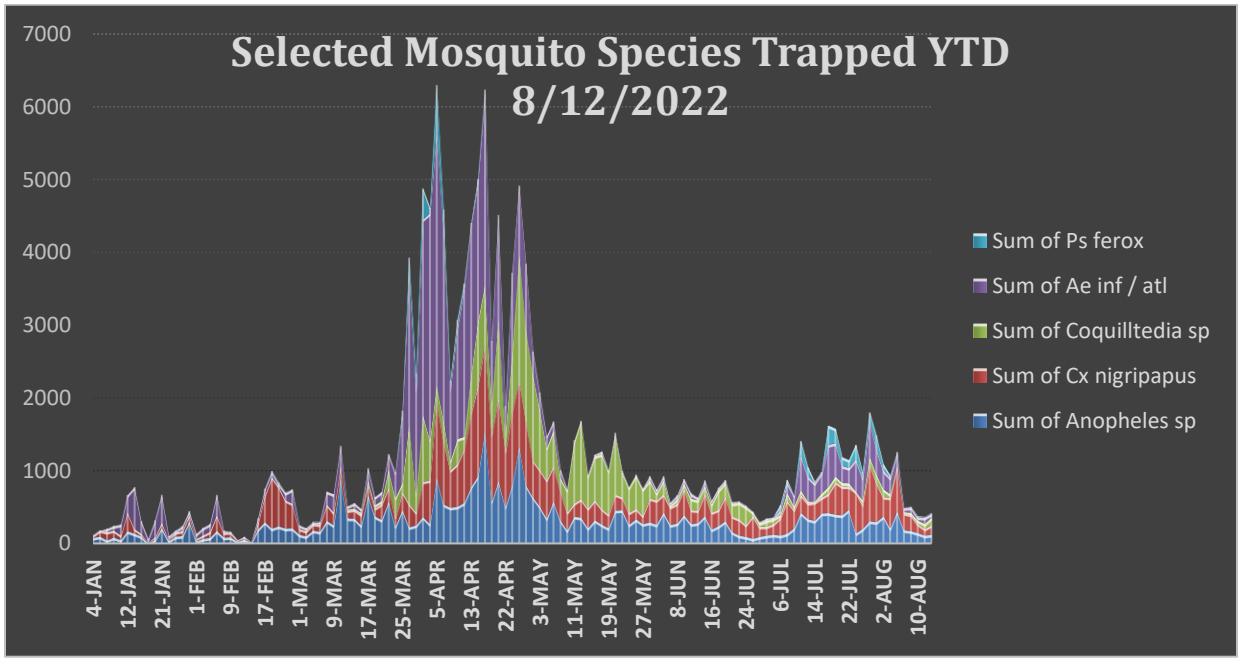


Week of 8/8/2022 Operations Update

The mosquito population stayed low this week after finishing last week with very low numbers. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).

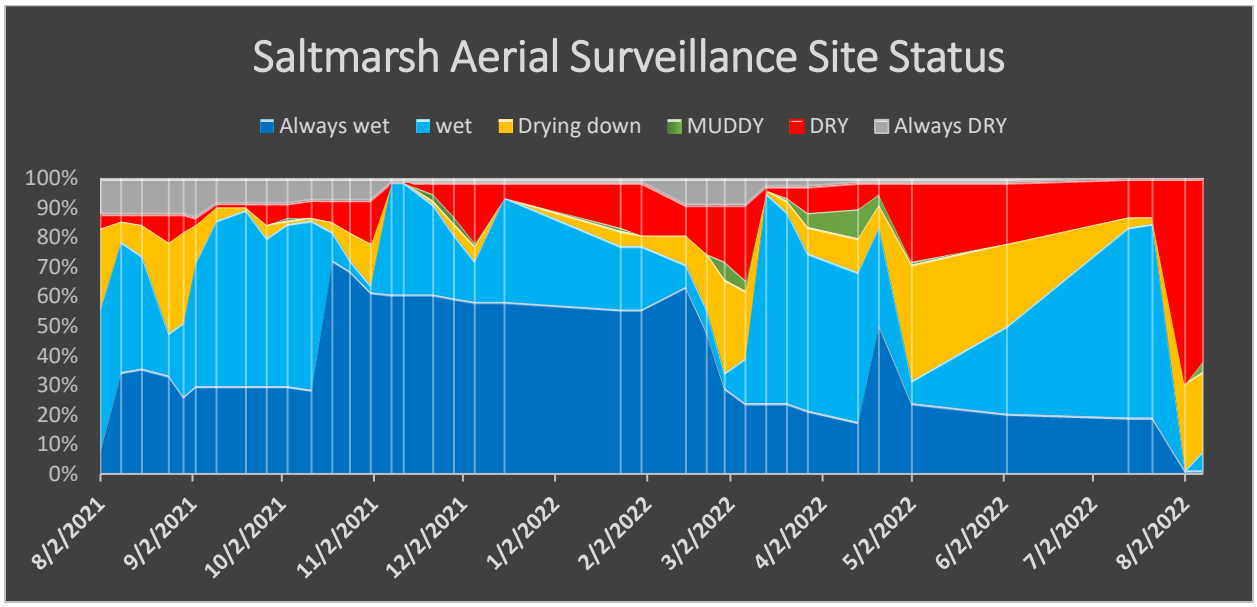


Mosquito activity was isolated to a few zones this week in the southwest of the District. All mosquito species populations were suppressed (Chart below).

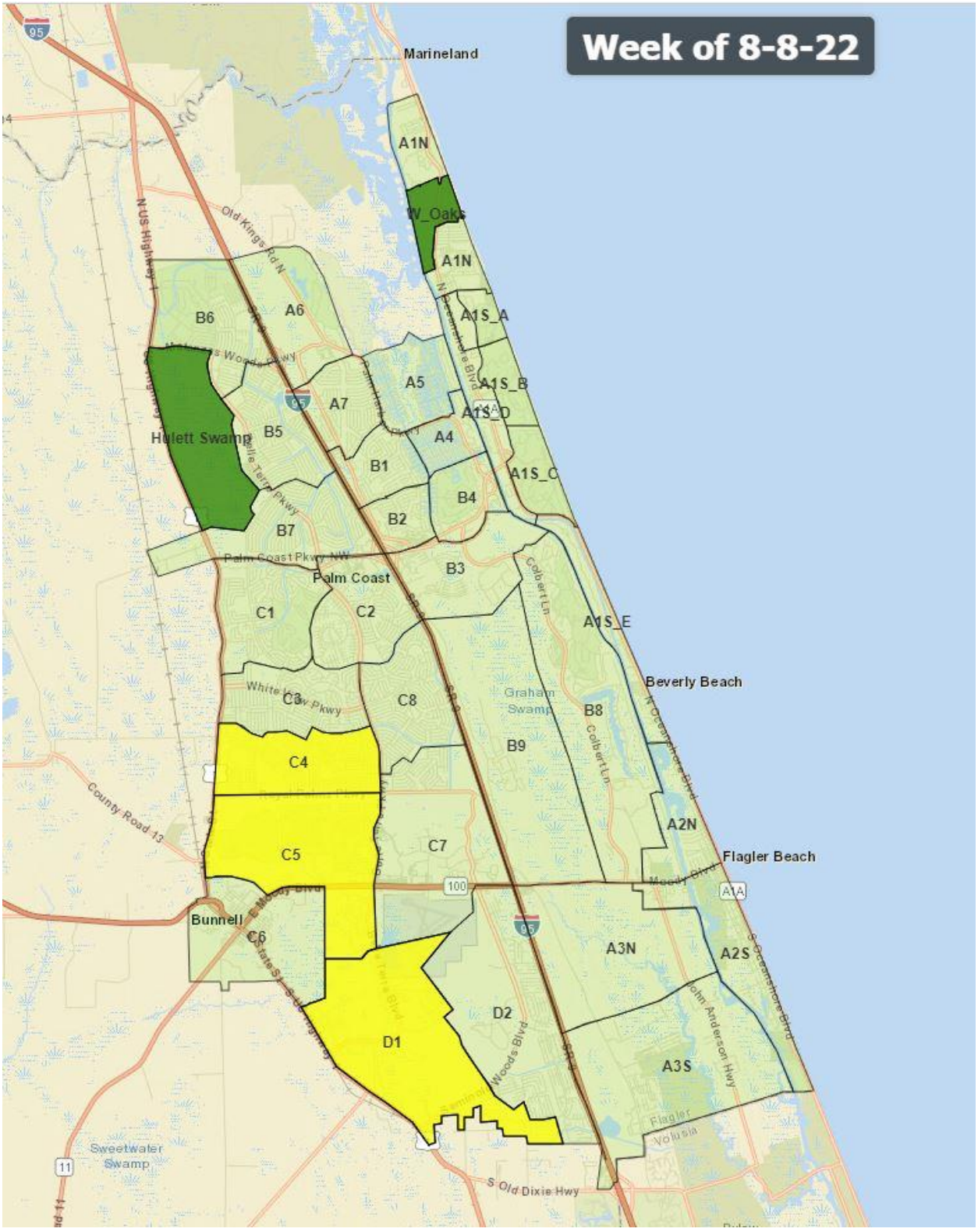


The mosquito population is a function of precipitation and as the breeding sites dry down mosquitoes are unable to replenish themselves as they require water to complete the immature life stages. In 1952 the District was established for the control of saltmarsh mosquitoes so that the coastal areas would be habitable. Saltmarsh mosquito breeding is also dependent on above normal tides to inundate areas above the intertidal zone. The District monitors these breeding sites in the saltmarsh by a combination of personnel on the ground, helicopter reconnaissance for remote and inaccessible areas, and more recently through the use of soil moisture probes and cameras with cellular connectivity for constant real time monitoring.

The Chart below is for the past year of surveillance for sites monitored by helicopter. These are the sites that are the largest as well as the most remote. Special attention is paid to the saltmarsh because the two species that breed in the saltmarsh *Aedes taeniorhynchus* and *Aedes sollicitans* are by far the most aggressive biters and have the greatest flight range of up to 20 miles.

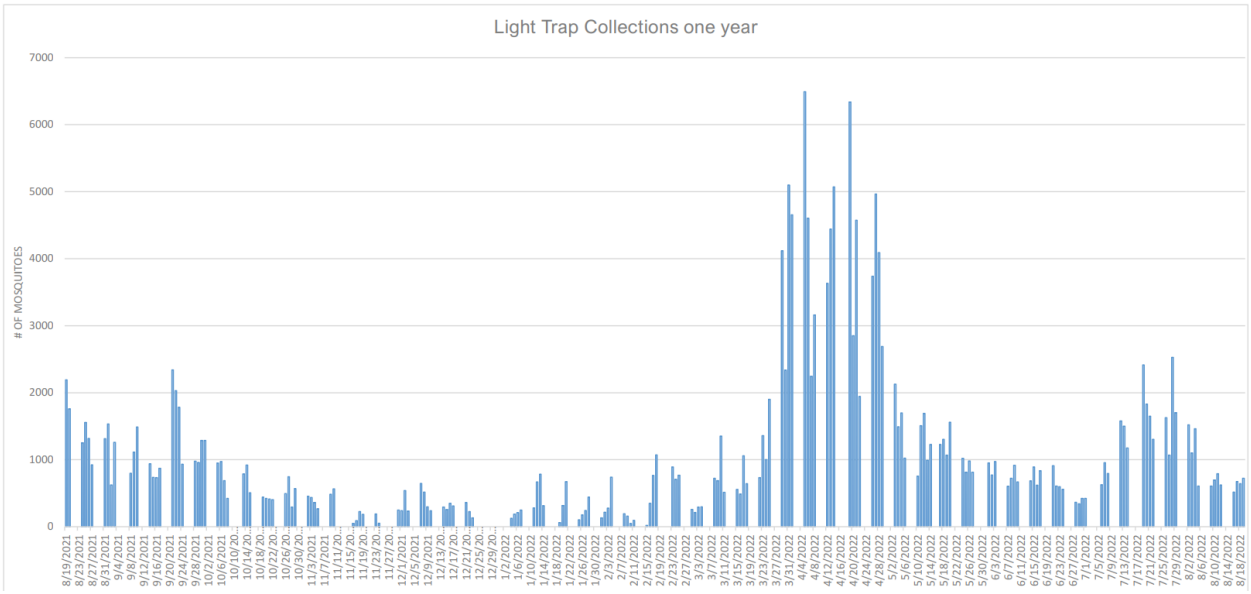


Zones highlighted in yellow were sprayed by truck this week.

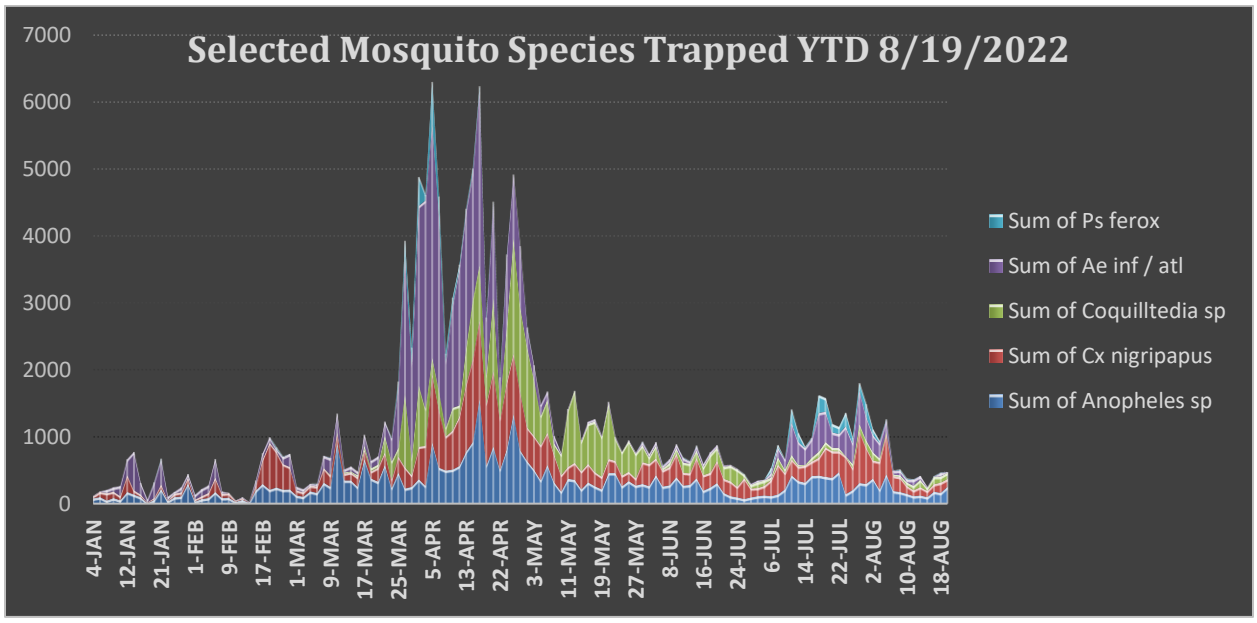


Week of 8/15/2022 Operations Update

This week was the second week of low mosquito activity after four weeks of moderate mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Limited rainfall and high heat have reduced mosquito production since early August (Chart below).



From the Florida Department of Health Arbovirus Surveillance Week 33: August 14-20, 2022 Report:

WNV activity: One human case of WNV infection was reported this week in Volusia County.

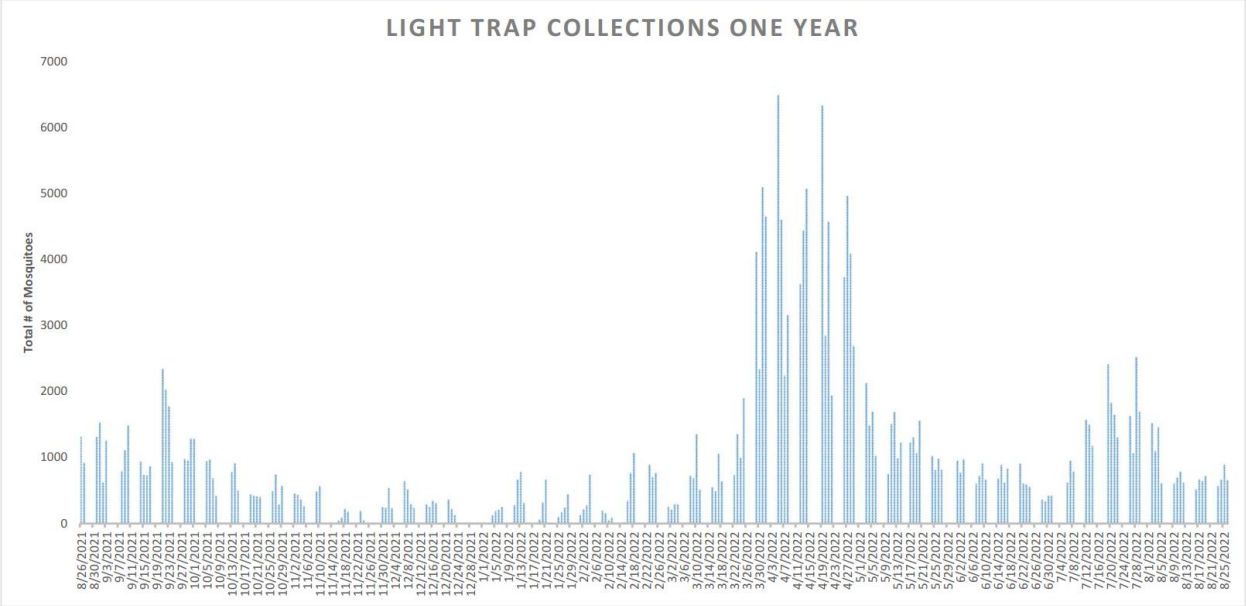
Dengue Cases Acquired in Florida: Two cases of locally acquired dengue were reported this week in Miami-Dade County. In 2022, five cases of locally acquired dengue have been reported.

Advisories/Alerts: Miami-Dade County is currently under a mosquito-borne illness alert. Bay, Charlotte, Lee, Osceola, Pinellas, Sarasota, and Volusia counties are currently under a mosquito-borne illness advisory. No other counties are currently under a mosquito-borne illness advisory or alert.

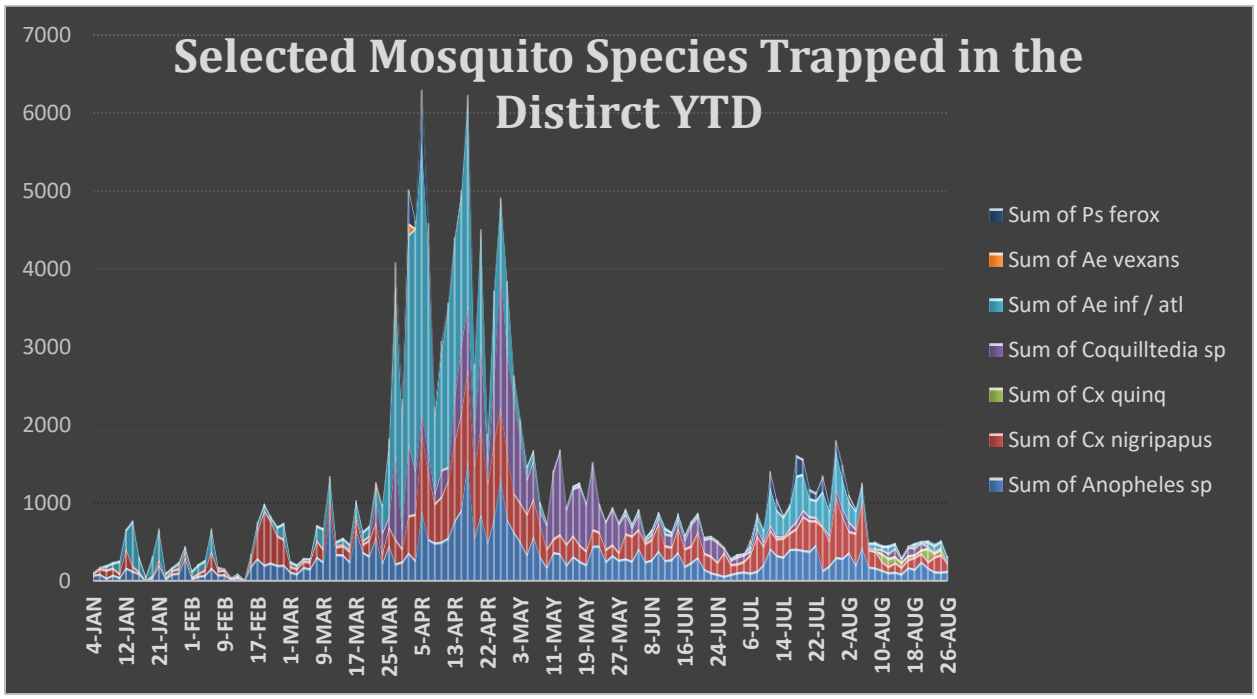
No Adulticide treatments this week.

Week of 8/22/2022 Operations Update

This week was the third week of low mosquito activity after four weeks of moderate mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Limited rainfall and high heat have reduced mosquito production since early August (Chart below). The presence of *Aedes infirmatus* was detected in the vicinity of Town Center, likely due to pumping and dewatering related to construction in the area.

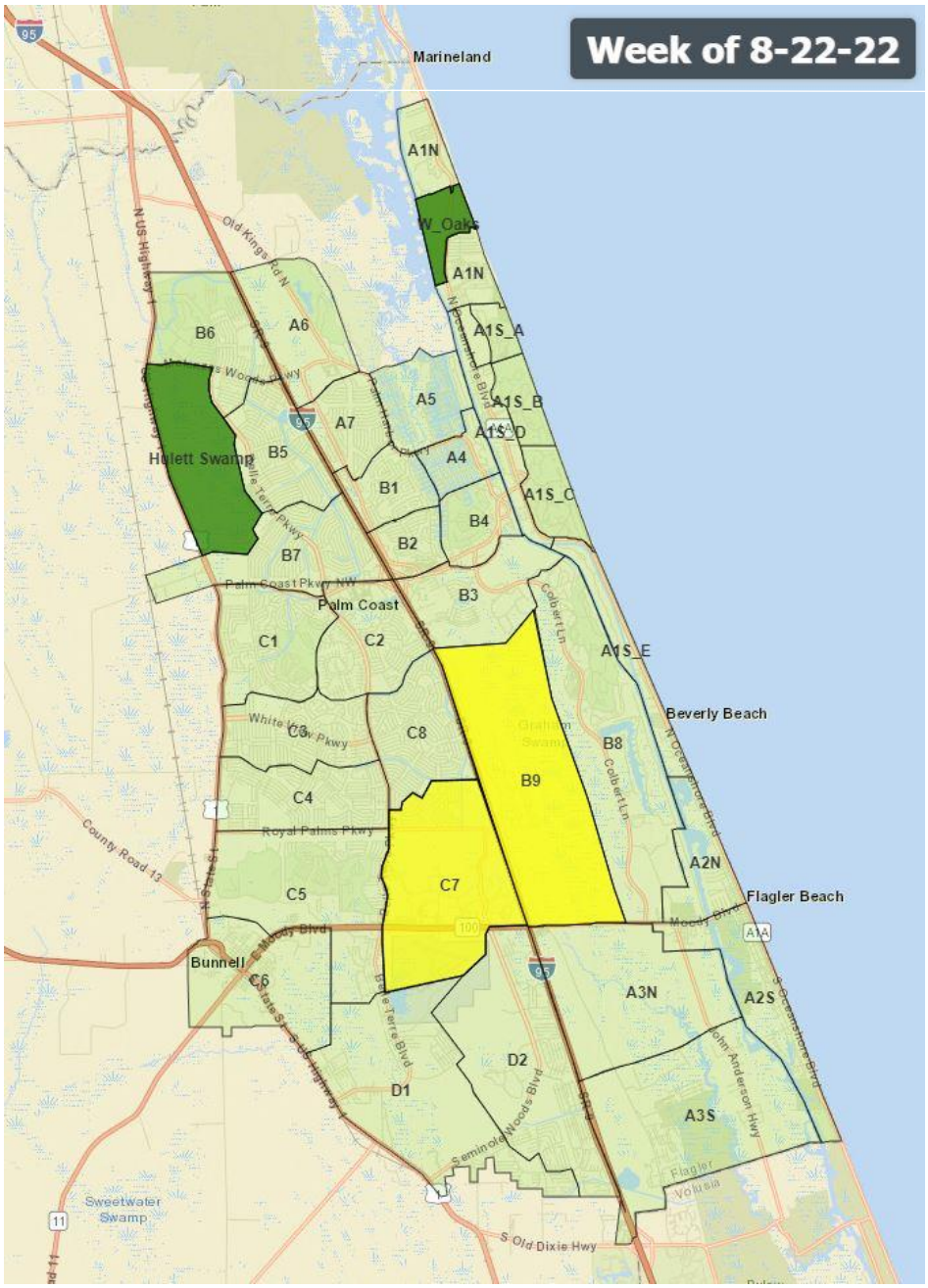


From the Florida Department of Health Arbovirus Surveillance Week 34: August 21-27, 2022 Report:

Dengue Cases Acquired in Florida: Three cases of locally acquired dengue were reported this week in Collier and Miami-Dade counties. In 2022, eight cases of locally acquired dengue have been reported.

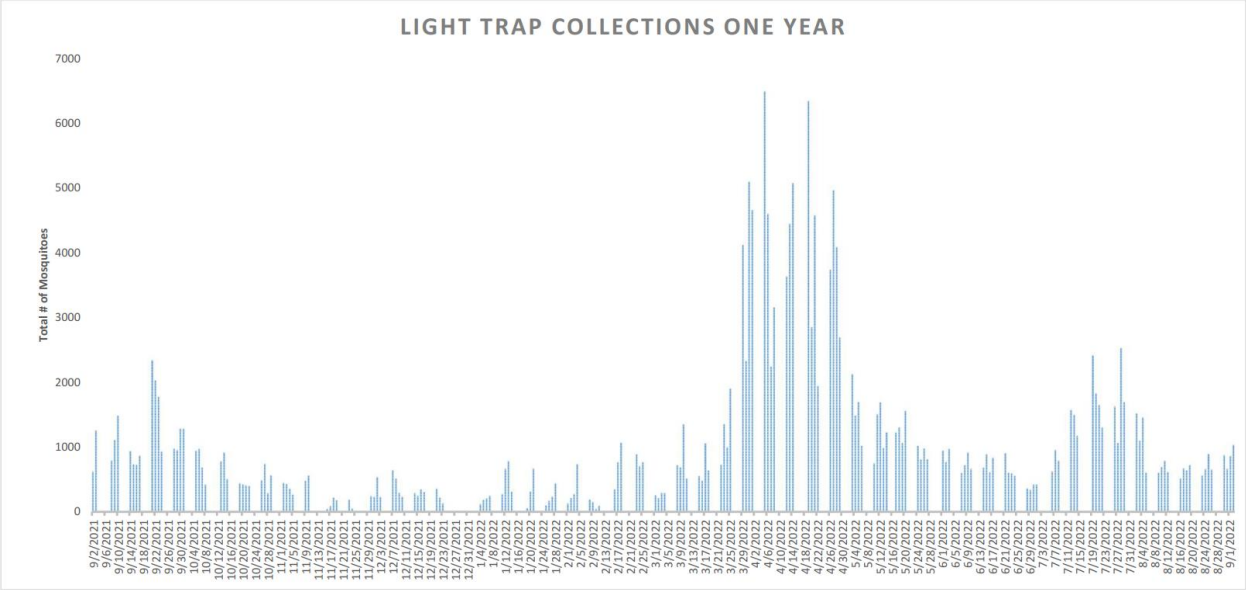
Advisories/Alerts: Miami-Dade County is currently under a mosquito-borne illness alert. Bay, Charlotte, Collier, Lee, Osceola, Pinellas, Sarasota, and Volusia counties are currently under a mosquito-borne illness advisory.

Zones high-lighted in yellow were sprayed by truck this week.

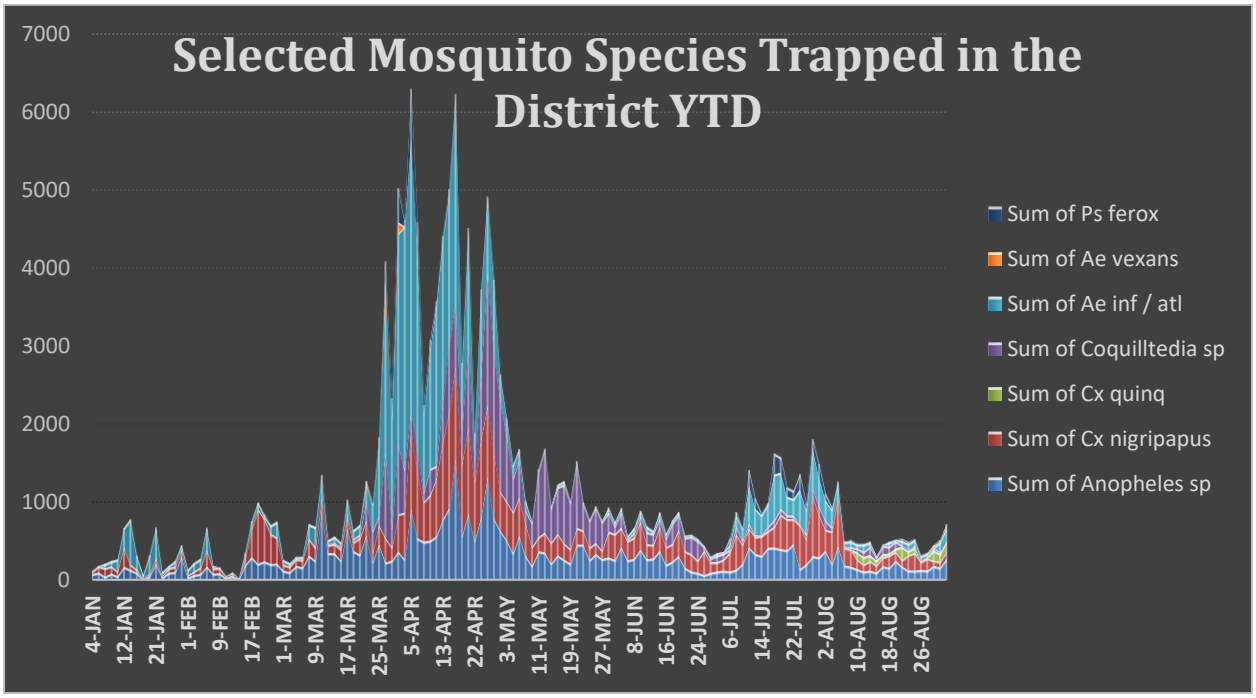


Week of 8/29/2022 Operations Update

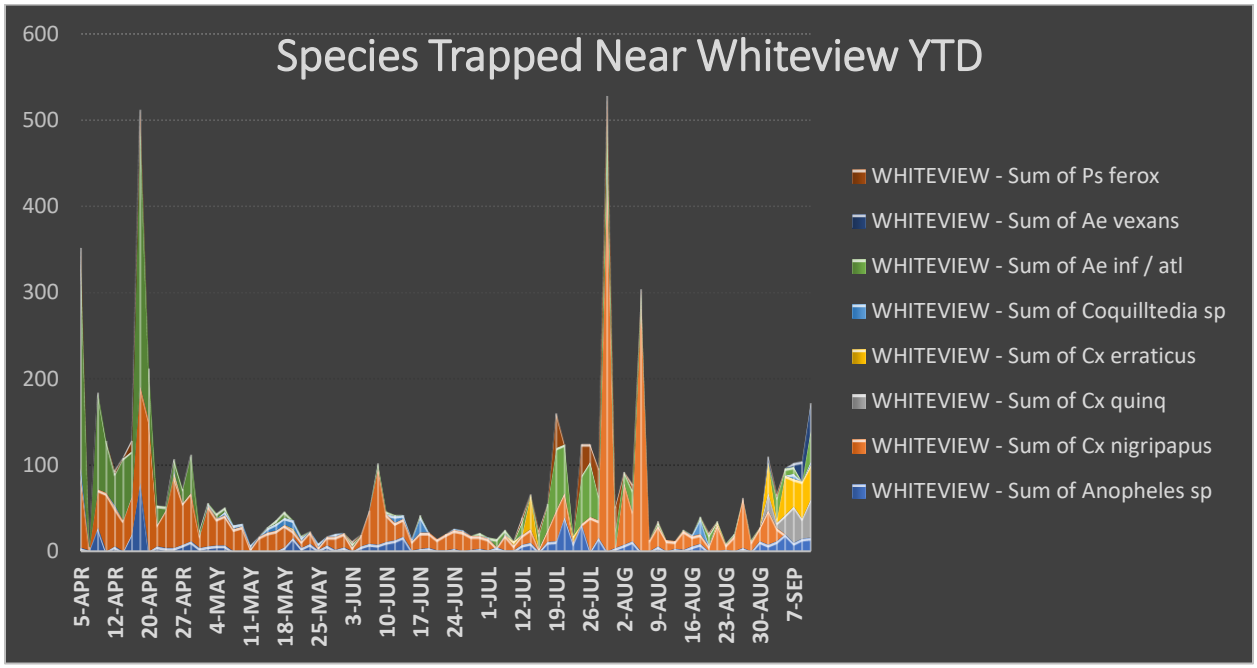
This week was the fourth week of low mosquito activity after four weeks of moderate mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Limited rainfall and high heat have reduced mosquito production overall since early August (Chart below).



However, zooming in on surveillance data from the trap near Whiteview BLVD, there was as uptick this week in several species that warranted control measures (Chart Below).



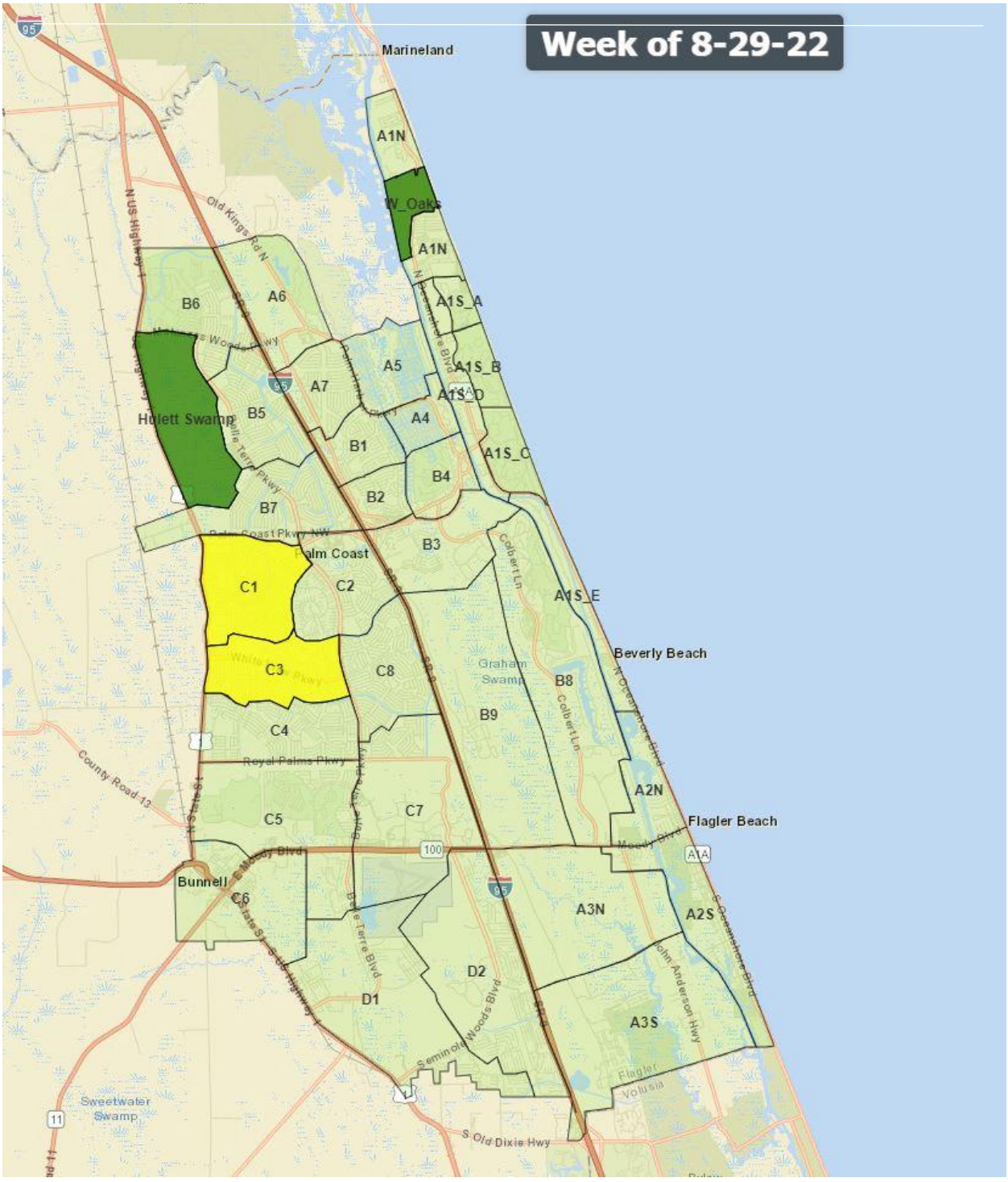
From the Florida Department of Health Arbovirus Surveillance Week 35: August 28 -September 3, 2022 Report:

Dengue Cases Acquired in Florida: Six cases of locally acquired dengue were reported this week in Miami-Dade County. In 2022, 14 cases of locally acquired dengue have been reported.

Advisories/Alerts: Miami-Dade County is currently under a mosquito-borne illness alert. Bay, Charlotte, Collier, Lee, Osceola, Pinellas, Sarasota, and Volusia counties are currently under a mosquito-borne illness advisory. No other counties are currently under a mosquito-borne illness advisory or alert.

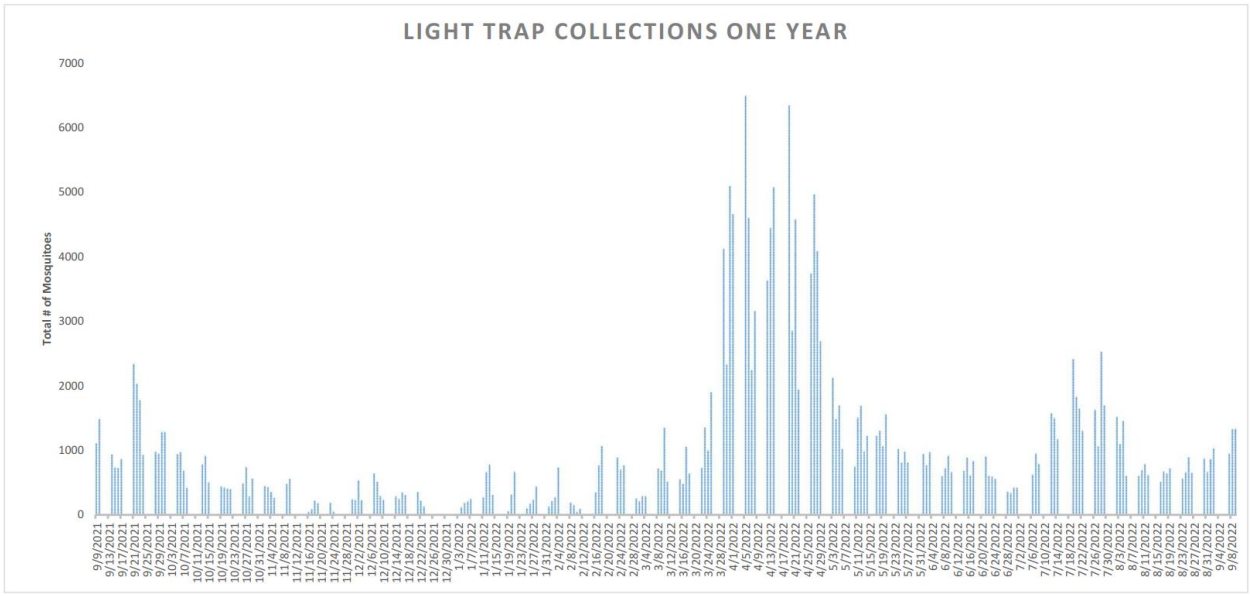
For a bit of context, Miami-Dade's high population density and high volume of international travel increases the probablility of human to mosquito disease transmission. Our Director was part of a Department of Health strike team that responded to a Dengue outbreak in Martin County in 2013. He reports Martin County and Flagler County are very similar in density and population structure. The original infected traveler was found to have spread Dengue from the bite of *Aedes albopictus* that was breeding in bromeliads at their residence. We advise all residents to remove bromeliads from their yard.

Zones high-lighted in yellow were sprayed by truck this week.

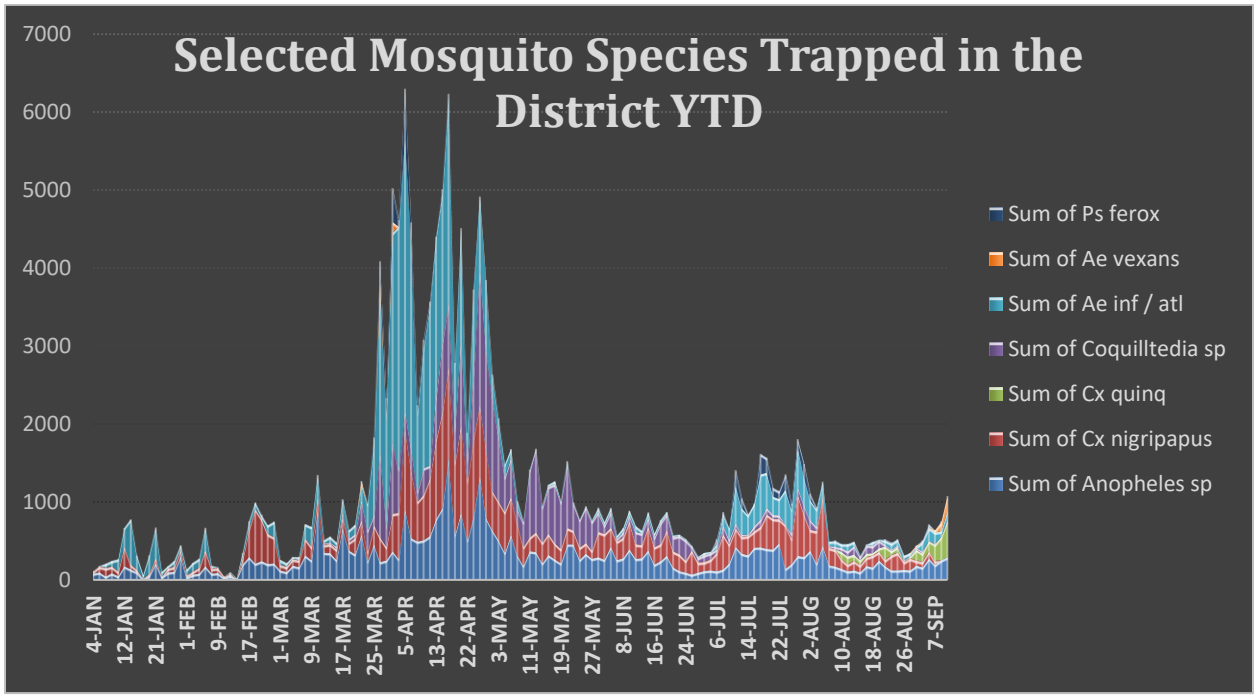


Week of 9/5/2022 Operations Update

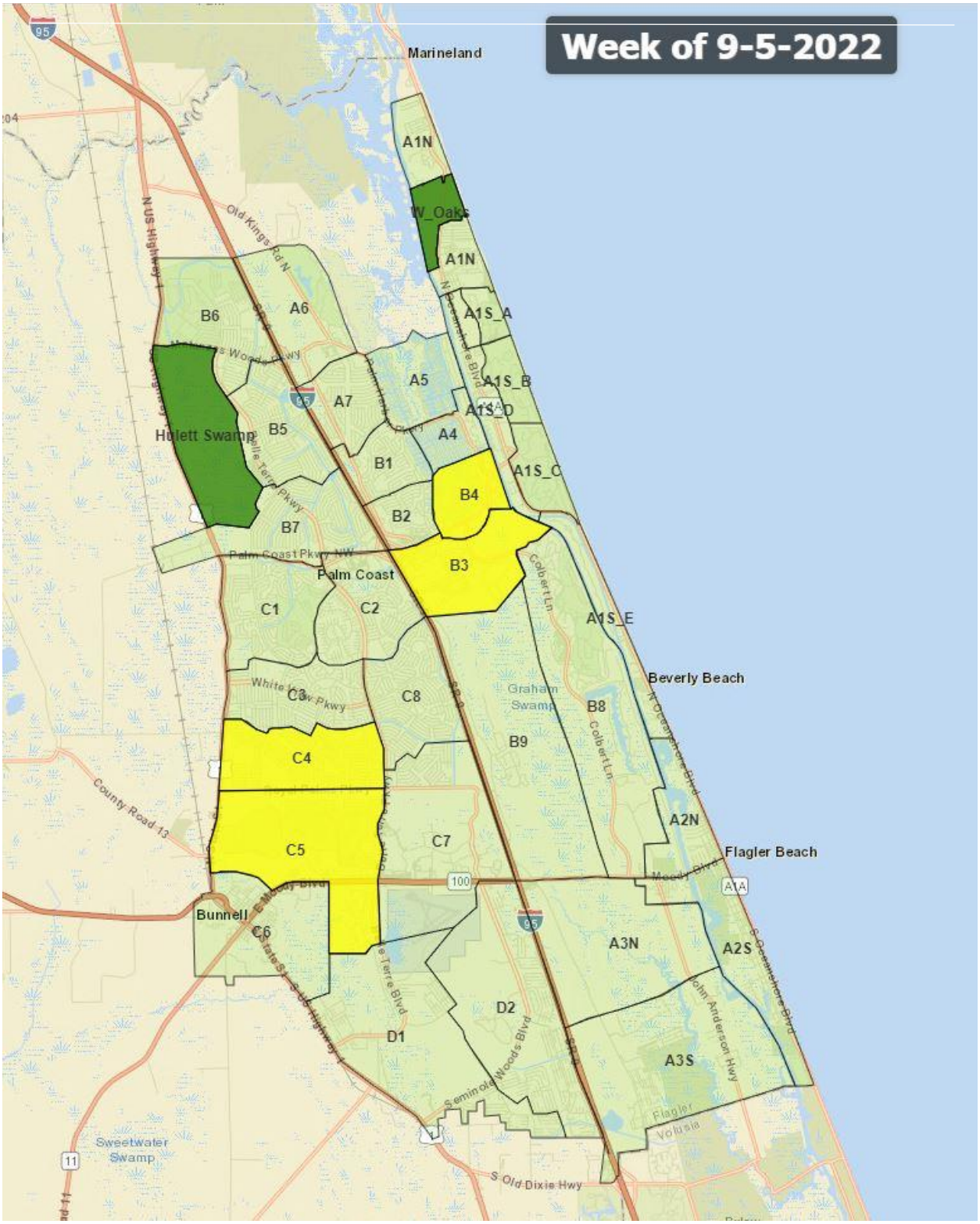
This week saw moderate mosquito activity after four weeks of low mosquito activity. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



Limited rainfall and high heat have limited mosquito production overall since early August (Chart below). This week saw a notable increase in *Culex quinquefaciatus*.

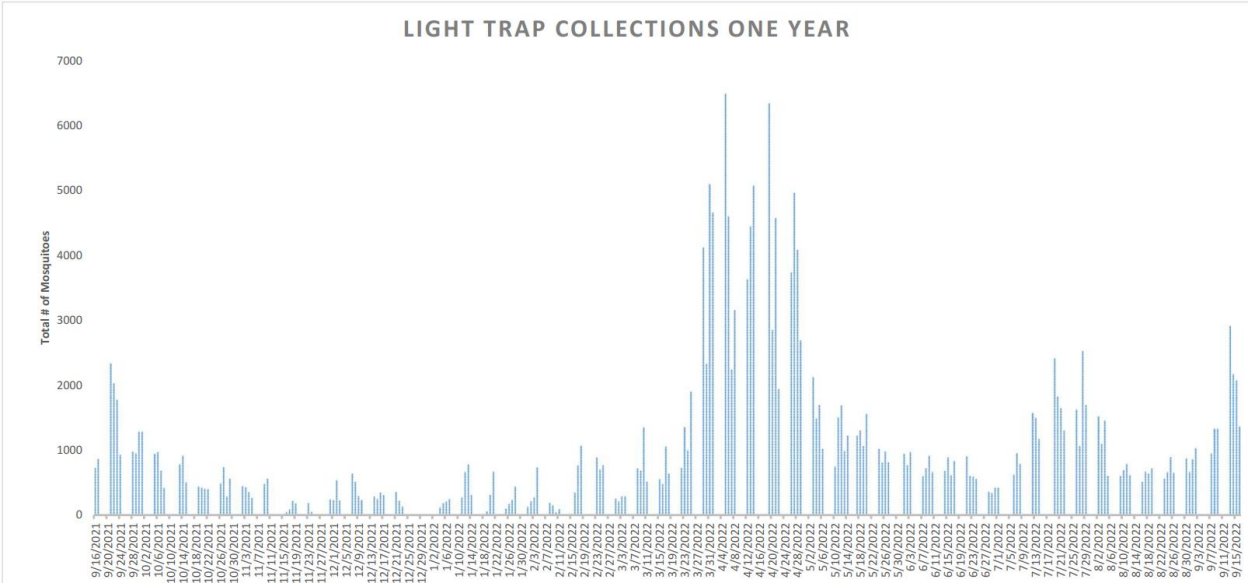


Zones high-lighted in yellow were sprayed by truck this week.

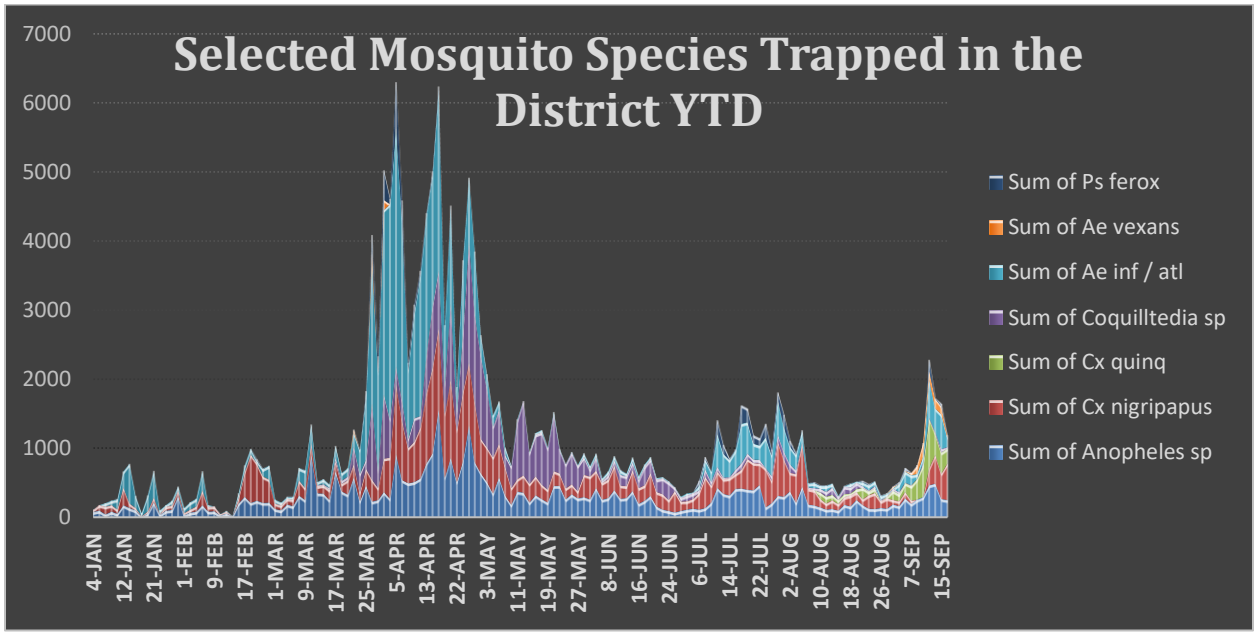


Week of 9/12/2022 Operations Update

An uptick of mosquito activity registered this week in our surveillance traps. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The addition of *Culex quinquefaciatus* this week and last in the trap collections made it so the bulk of the adult mosquitoes trapped were of the permanent water variety. *Aedes infirmatus* and *Aedes vexans,* which are flood water mosquitoes, were at elevated numbers as well but only mildly so (Chart below).

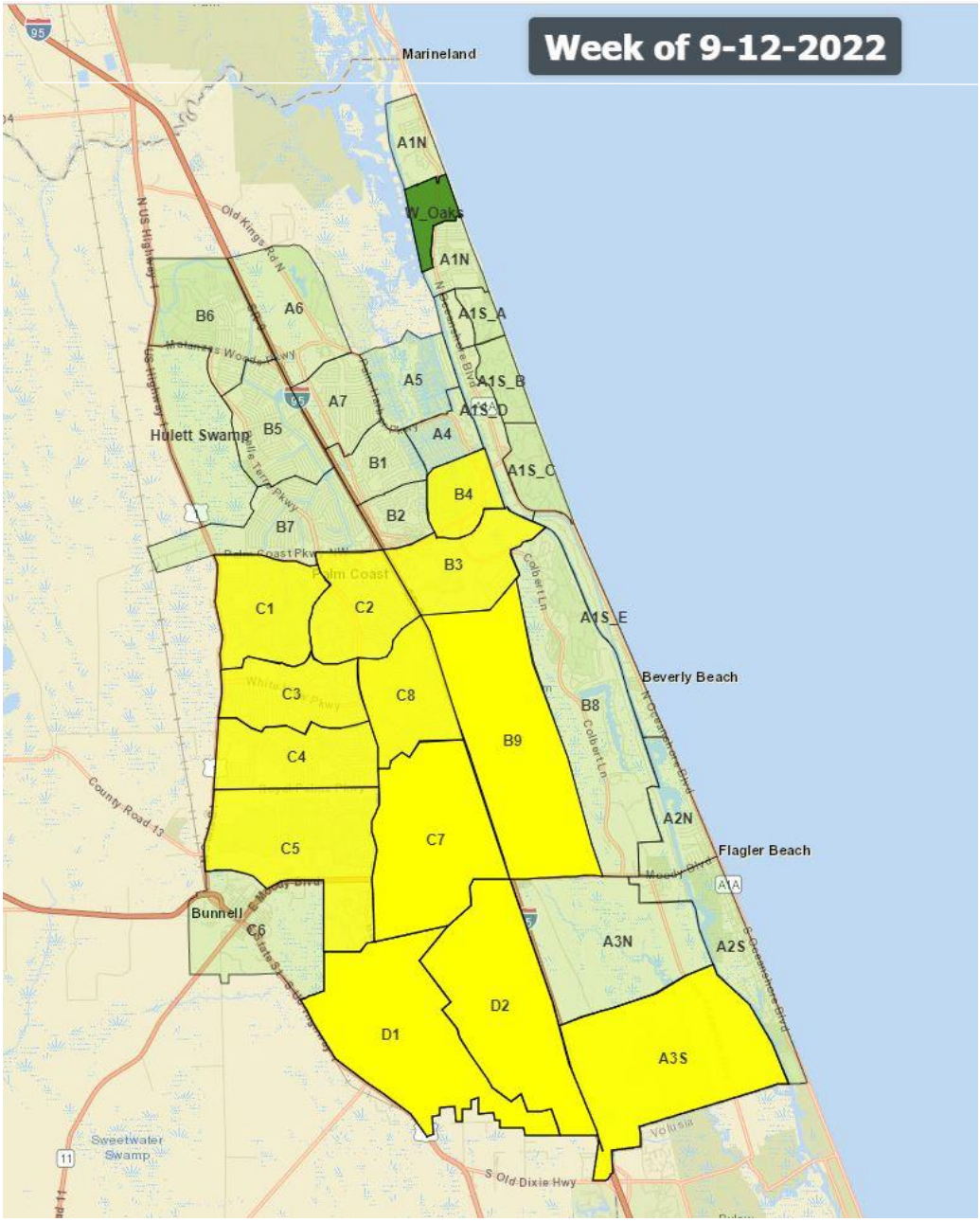


From the Florida Department of Health Arbovirus Surveillance Week 37: September 11-17, 2022 Report:

Dengue Cases Acquired in Florida: Five cases of locally acquired dengue were reported this week in MiamiDade County. In 2022, 19 cases of locally acquired dengue have been reported in Collier and Miami-Dade counties (18).

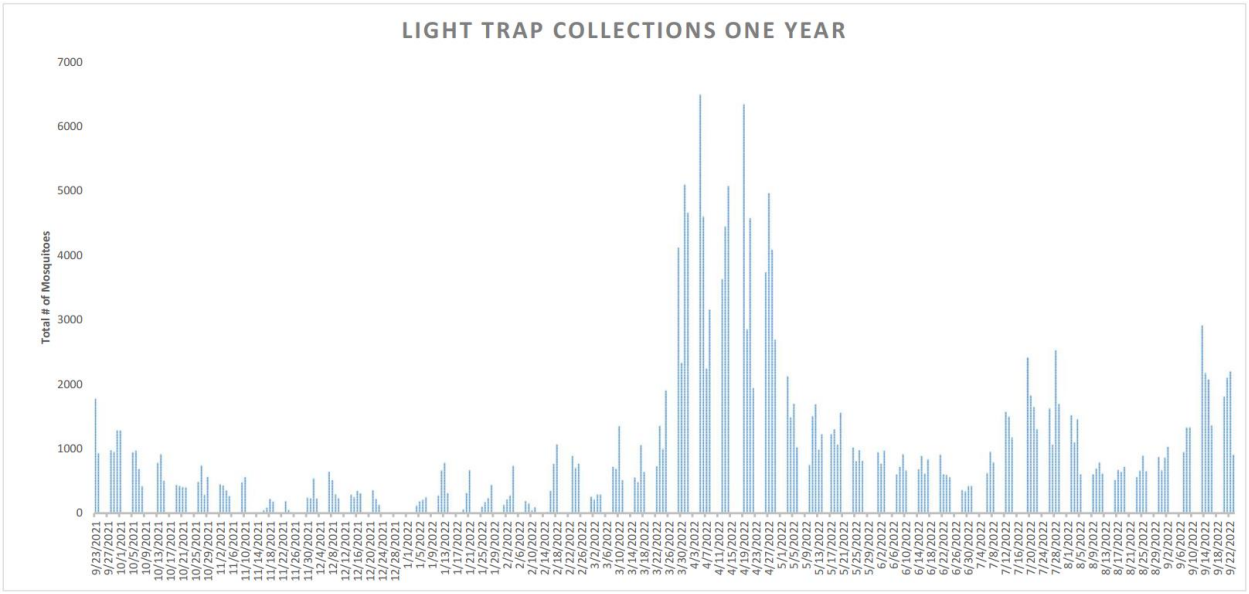
Advisories/Alerts: Miami-Dade County is currently under a mosquito-borne illness alert. Bay, Charlotte, Collier, Hillsborough, Lee, Osceola, Pinellas, Sarasota, and Volusia counties are currently under a mosquitoborne illness advisory.

Zones high-lighted in yellow were sprayed by truck this week.

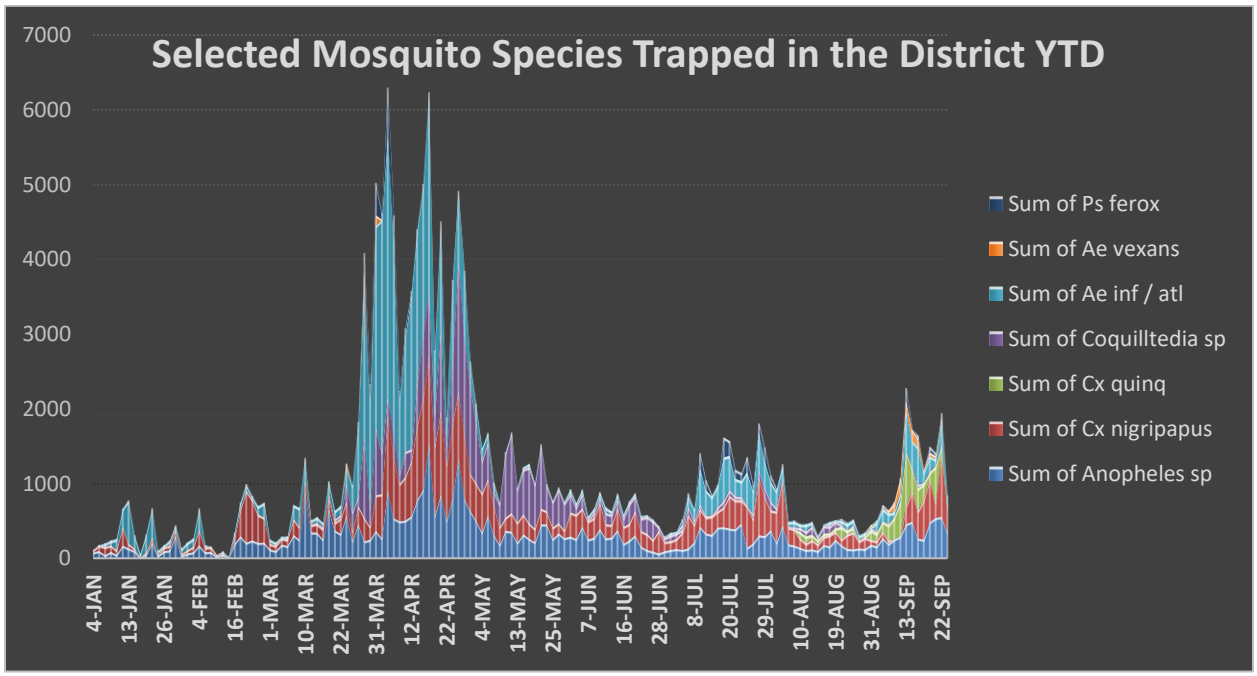


Week of 9/19/2022 Operations Update

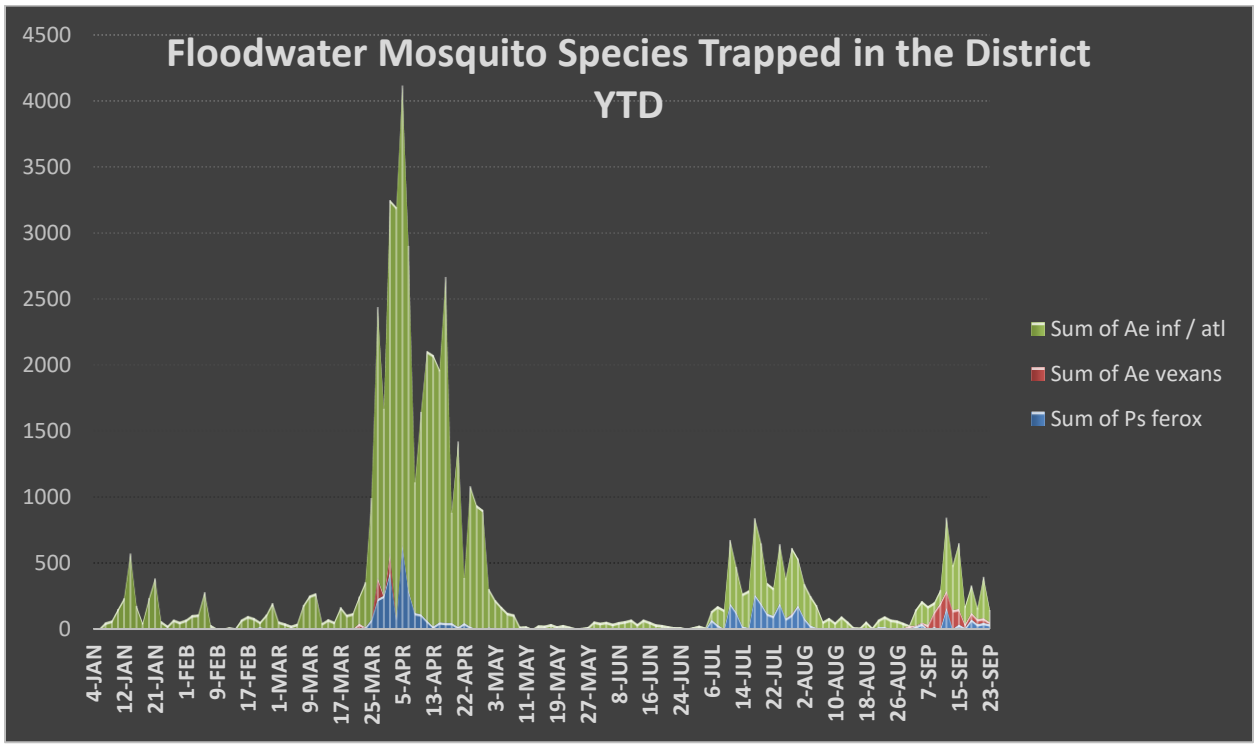
Another moderate week of mosquito activity but with no increase and a decline by week's end. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



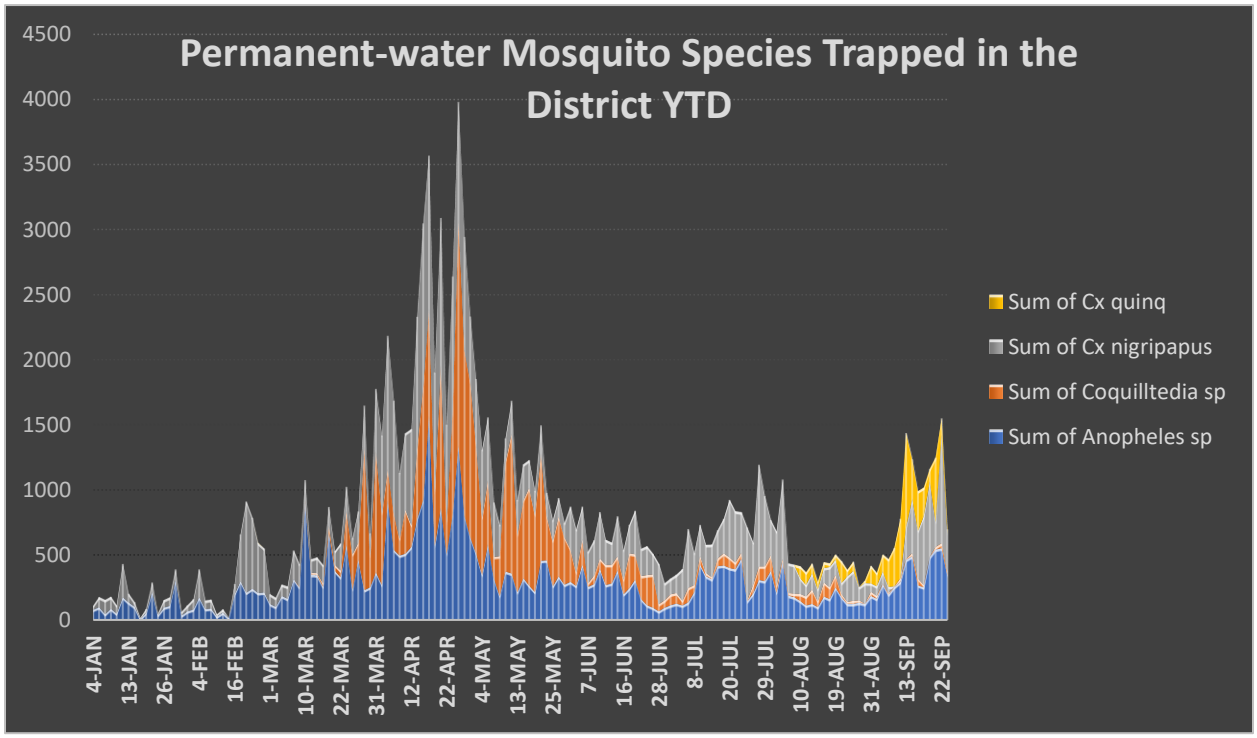
Continuing the theme from last week we noted, "the addition of *Culex quinquefaciatus* this week and last in the trap collections made it so the bulk of the adult mosquitoes trapped were of the permanent water variety. *Aedes infirmatus* and *Aedes vexans,* which are flood water mosquitoes, were at elevated numbers as well but only mildly so." The chart below represents both floodwater and permanent water types of mosquitoes.



Looking at just the population of floodwater type mosquito species you can see we have not had a major spike since April of this year (Chart below).

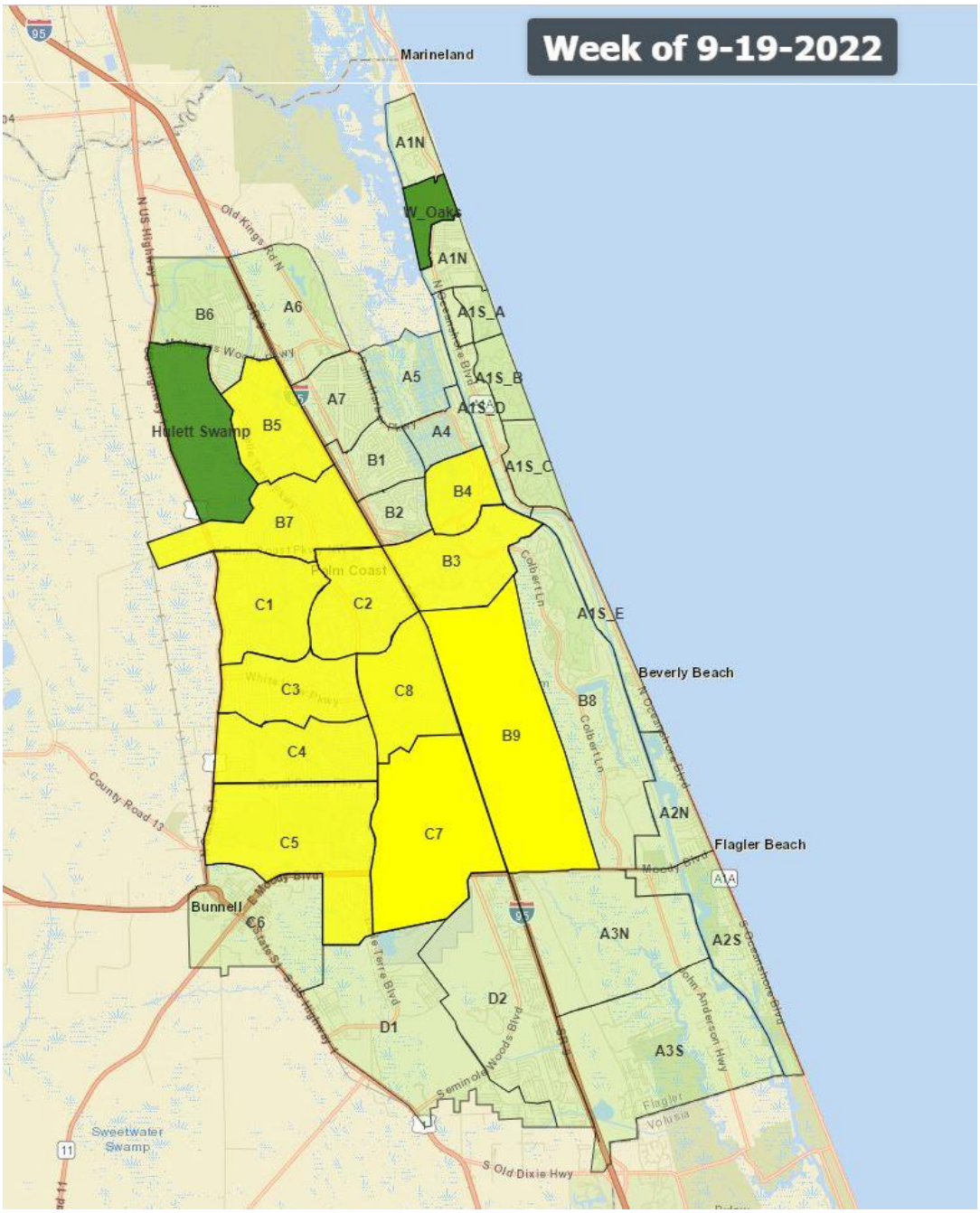


Whereas permanent-water species are currently on the rise and have stayed more consistent throughout the year.



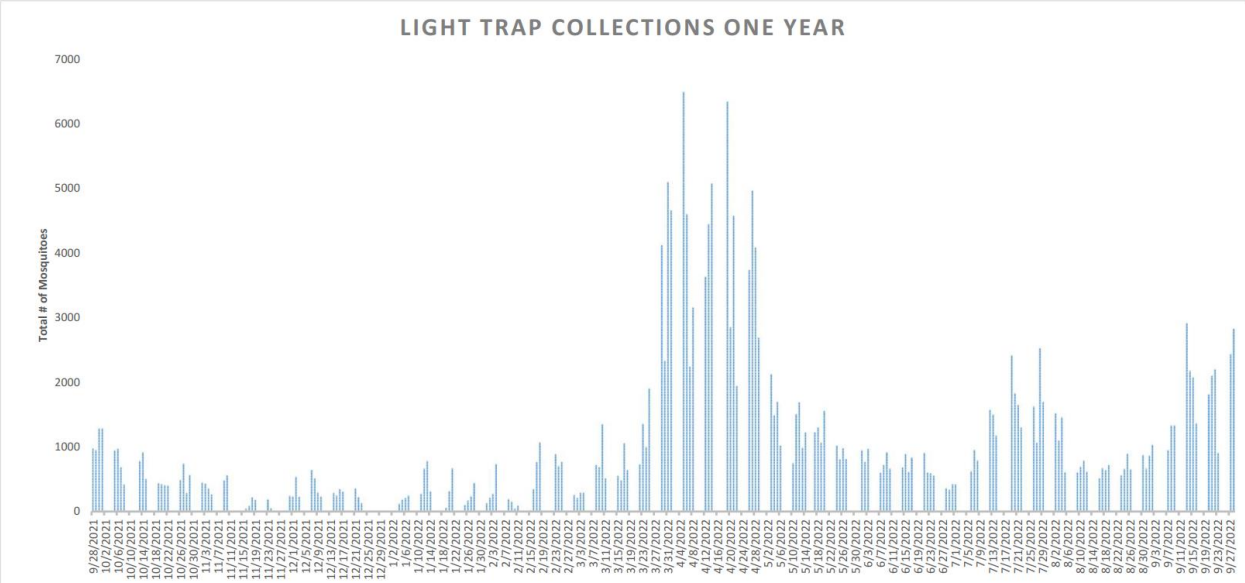
The main factor for the difference in prevalence among floodwater and permanent water mosquito types appears to be that the high heat during the summer prevented flood water from remaining long enough to permit a breeding cycle to occur, whereas enough rain was received to maintain standing water without drying down. Drying down permanently wet areas is a higher bar to clear because the water is deeper in these areas and is less prone to percolation by being closer to the water table.

Zones high-lighted in yellow were sprayed by truck this week.

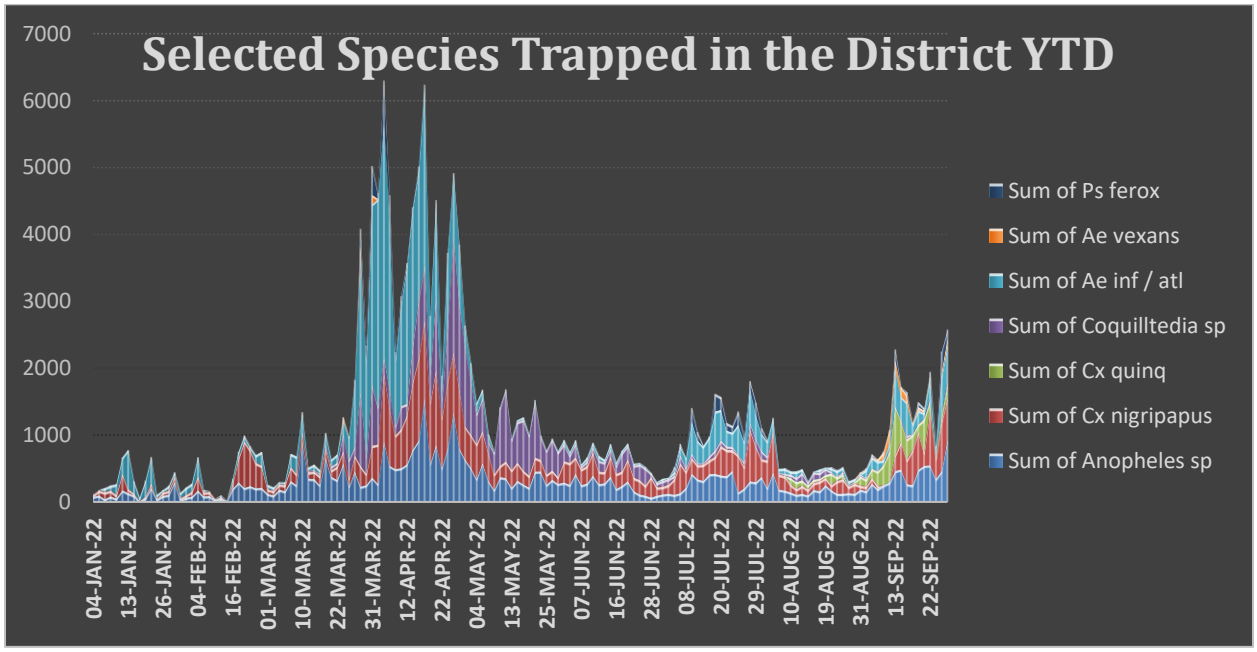


Week of 9/26/2022 Operations Update

An uptick in flood water species this week, but trapping was cut short due to Hurricane Ian. The bar graph below shows the total adult mosquitoes from all traps in the District for the past year (TTM).



The flood water species *Aedes infirmatus* increased considerably from the week previous, but Hurricane Ian interrupted our trap data collection, or the totals could have been higher by week's end (Chart Below).



No spraying this week due to Hurricane Ian.

Operations Update

Week of September 26, 2022 (Week 40)

Hurricane Ian Supplemental

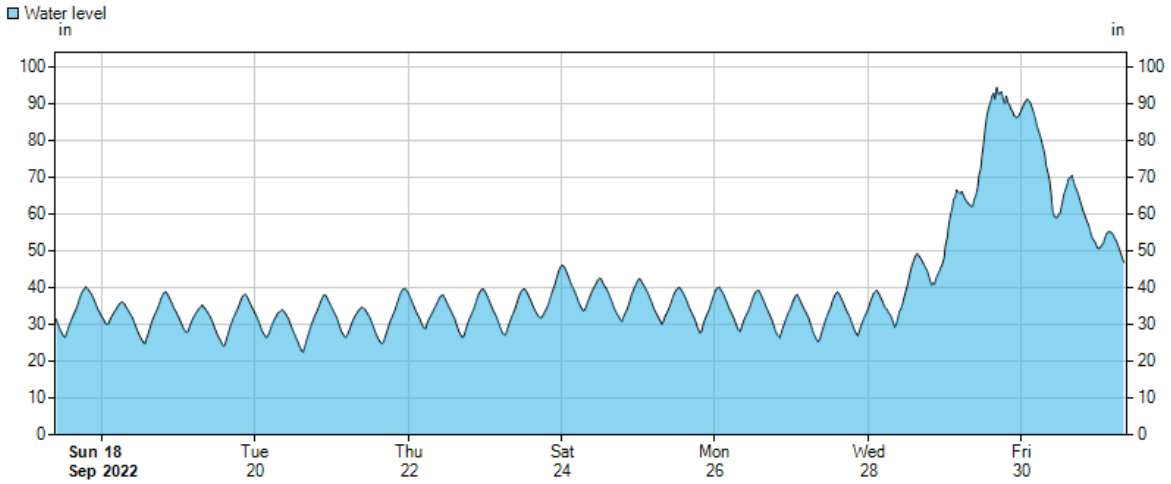
Hurricane Ian landed in Southwest Florida as a major Category 4 Hurricane on Wednesday September 28, 2022 near Fort Myers in Lee County. The storm then tracked Northeast across Orlando and exited the peninsular Florida near Port Orange in Volusia County.

Significant rainfall and sustained tropical storm force winds impacted Flagler County along with significant tidal surge. Much of our monitoring equipment remained operational during the impact of the storm with a lack of cellular connectivity being the only issue. A surveillance flight was pre-planned for Saturday morning to assess flooding in and around the District and the impact of the tidal surge.

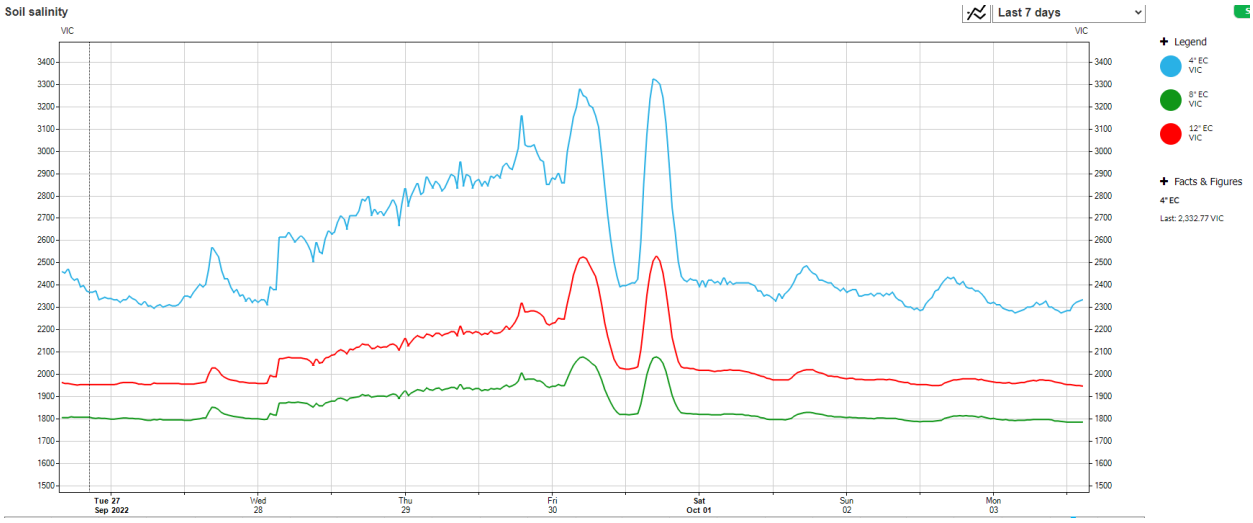
**Our data is not official data and is only used for mosquito control purposes.*

Tidal Surge:

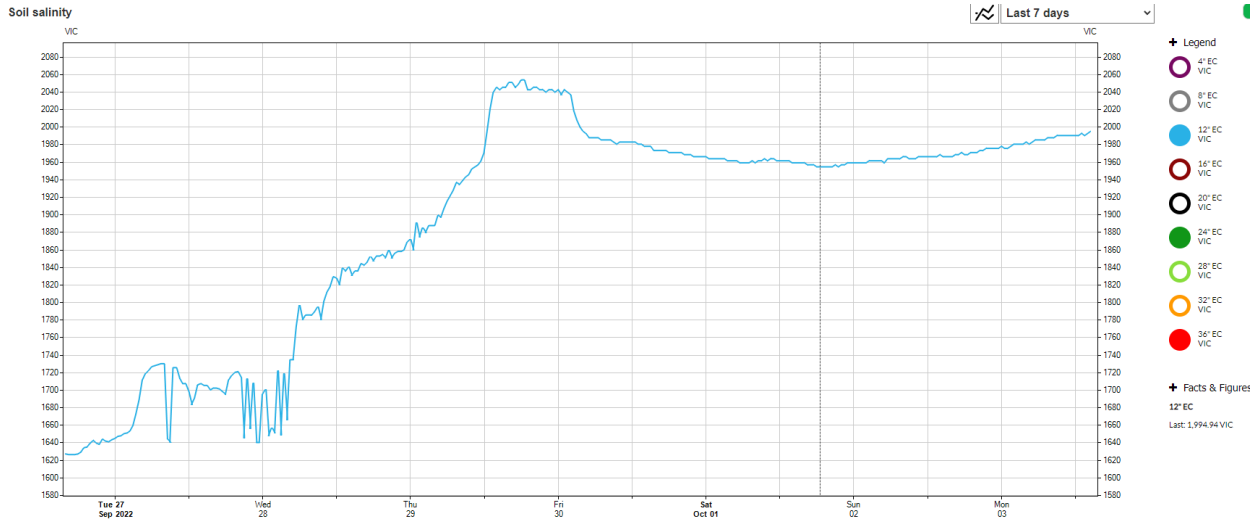
The District maintains an independent tide gauge in the saltmarsh near Long's Creek. The water elevation at this site doubled from a typical high tide of 45" to more than 90" (graph below).



The District also maintains soil moisture probes adjacent to the saltmarsh mosquito breeding sites, these probes record salinity and can indicate when they were inundated with salt water. The soil probe in Flagler Beach in the saltmarsh along the intracoastal registered a very high salinity as it was inundated with flood waters (Chart below).

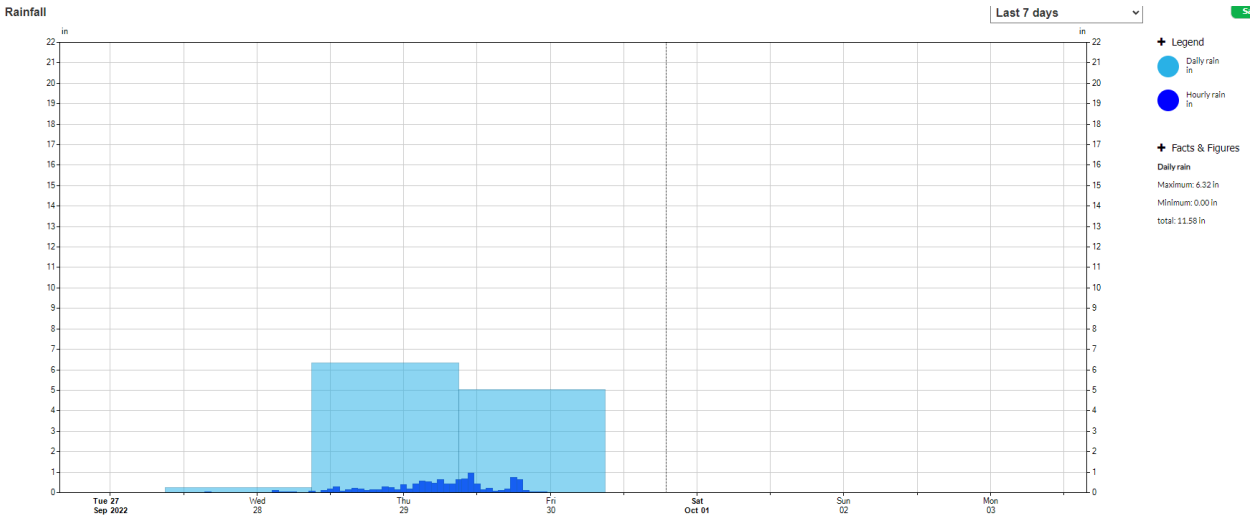


Washington Oaks State Park (inland) showed an increase in salinity as salt water flooded and mixed with rain accumulation in the monitored low lying area.

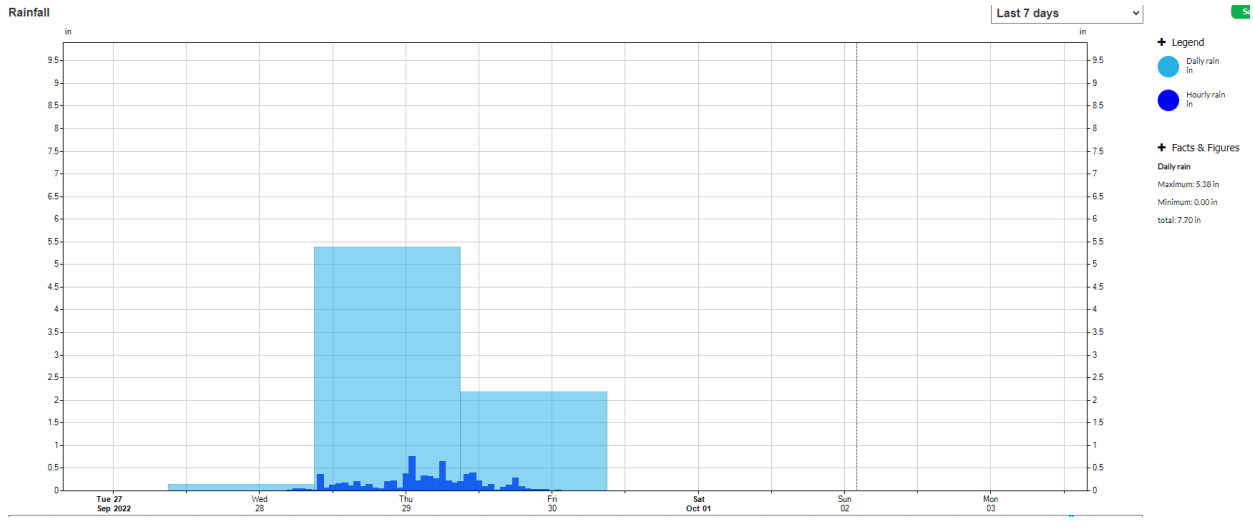


Rainfall:

Remote monitoring of mosquito breeding sites are selectively equipped with rain gauges also. Flagler Beach received 11.56 inches of rain over three days (graph below)



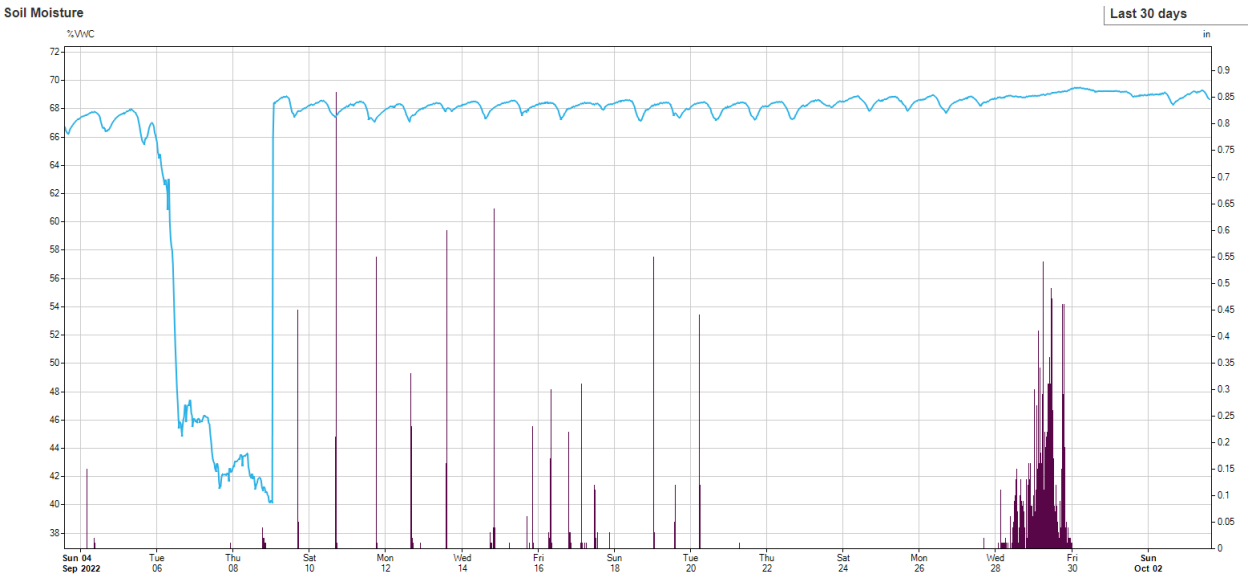
Washington Oaks Gardens State Park received 7.70 inches of rainfall over three days (Chart below).



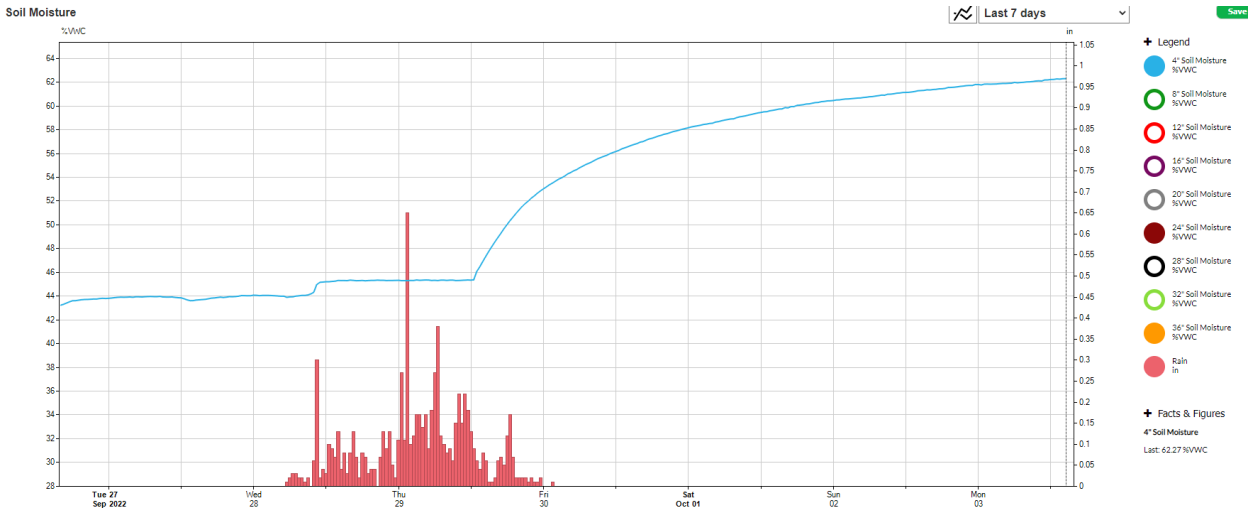
Soil Moisture:

The District monitors soil moisture to keep tabs on areas that flood and produce mosquitoes.

The Flagler Beach site was already wet (last 30 days, Chart below).



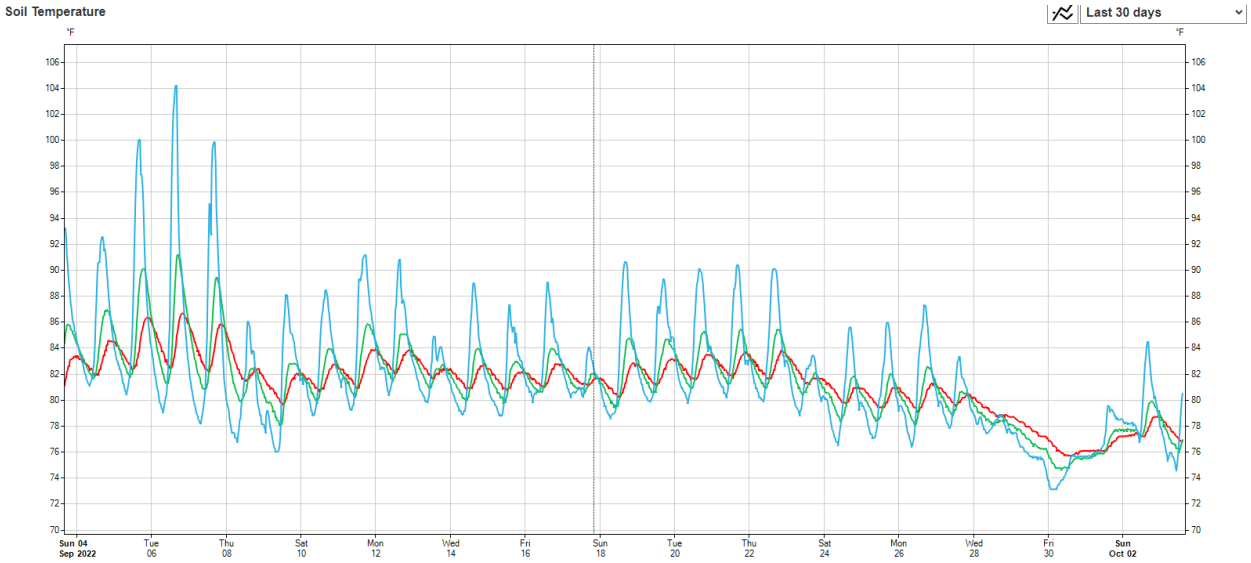
Washington Oaks State Park site did not become saturated until after the rainfall was received.



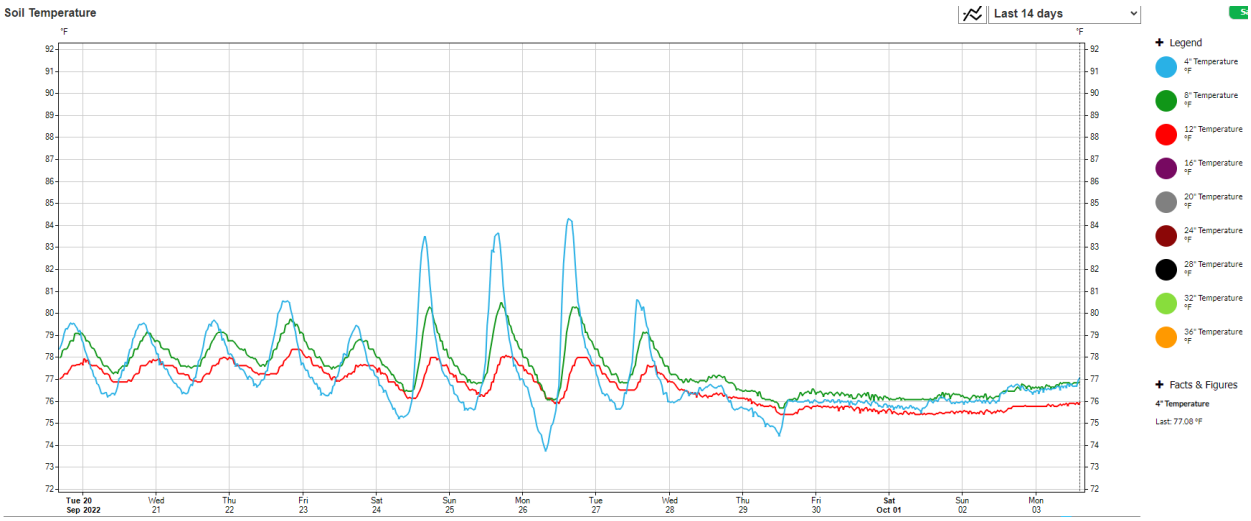
Temperature:

After Hurricane Ian moved beyond our area, temperatures cooled considerably to what felt like Fall weather which was quite the juxtaposition to the recent tropical cyclone. Cooler temperatures slow the development of immature mosquitoes. Under normal summertime conditions, mosquitoes progress from egg to larva, then pupa before finally emerging as a winged adult in about seven days. However, the cooler temperature can prolong this process by as much as double and could take fourteen days to complete.

The Flagler Beach site, which had been wet for some time, was much hotter before being flooded.



Washington Oaks State Park shows daytime fluctuations in temperature until being inundated.



Aerial Reconnaissance:

The District was requested by the County EOC to assist with aerial reconnaissance of flooding on the western side of the County. A flight was prearranged for Saturday morning with personnel from the public works and the EOC joining us. Between US 1 and Daytona North the low-lying areas were flooded. Several roads in Daytona North were submerged.

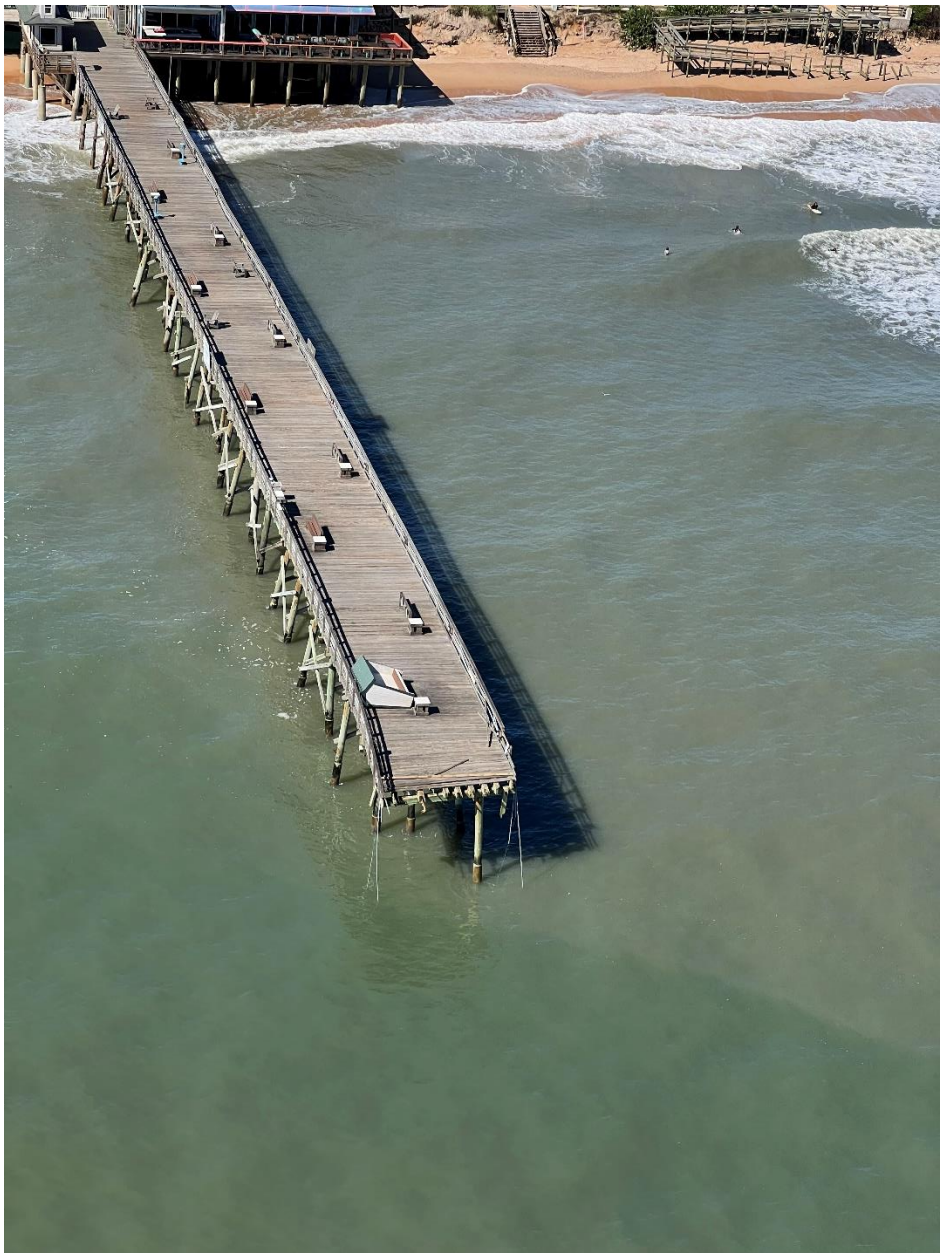
Daytona North

Saltmarsh areas were also flooded, roads were under water, and the beach sustained erosion.

Bulow Creek

Walter Boardman Lane

High Bridge Road



The Pier in Flagler Beach was Damaged

Significant erosion North of the pier

Washington Oaks Gardens State Park (monitoring equipment is located here)

North of Marineland

We wish all our neighbors a speedy recovery and our thoughts are with all Floridians who have suffered the wrath of Ian.