# An Investigation of California Serogroup Viruses in the Vancouver Coastal Health Region in Response to a Cluster of Pediatric Encephalitis: a Pilot Project for Enhanced Mosquito Surveillance

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*We gratefully acknowledge that we are gathered on the unceded, traditional, and ancestral lands of First Nations in this place currently known as British Columbia where we work, play and live.*

*First Nations have been responsible for stewarding this land for all time and we give thanks as uninvited guests on these lands.*

*We recognize the historic and ongoing colonial impacts on all First Nations, Métis Peoples and Inuit that call this land home.*

Lílwat Nation

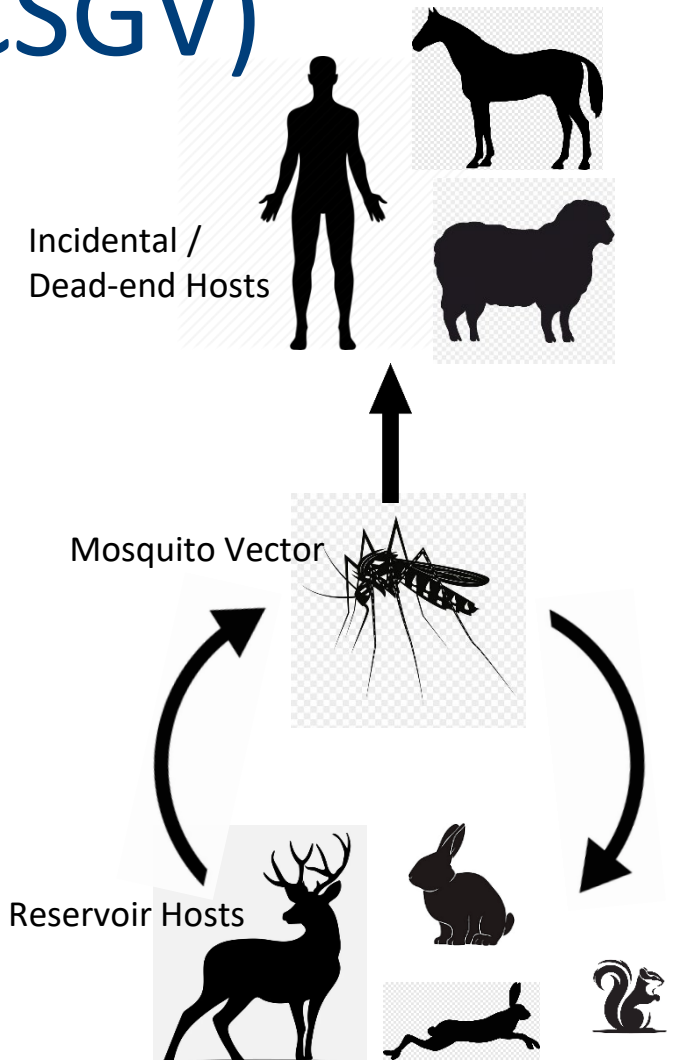
Sḵwx̱wú7mesh Úxwumixw
Squamish Nation

# California Serogroup Viruses (CSGV)

- Mosquito-borne virus of *Orthobunyavirus*[1]
  - Reservoirs:
    - Snowshoe Hare Virus (SSHV)- snowshoe hares, ground squirrel, chipmunk, rat[2]
    - Jamestown Canyon Virus (JCV)- elk, deer, mammals[3]
  - Hosts: humans, horses[4] , dogs, pigs, mice, foxes, caribou
- Infection symptoms
  - Asymptomatic
  - Early symptomatic: 1-4 days, flu-like symptoms
  - Neuroinvasive: rare
    - Encephalitis, meningitis

# California Serogroup Viruses (CSGV)

- Transmitted through the bite of specific infected *Aedes, Culiseta,* or *Anopheles* mosquito species[5]
- CSGV cases sporadic throughout Canada[5]
  - Nationwide: SSHV, JCV (Quebec)[5]
  - Not nationally notifiable
  - 15 in BC since 2009
- Climate change and range expansion
  - *Aedes japonicus* (invasive)
- Recent cases:
  - Malaria - Tacoma-Pierce[6], New Jersey[7]
  - Chikungunya - New York[8]



# A Changing Climate & Increased Risk

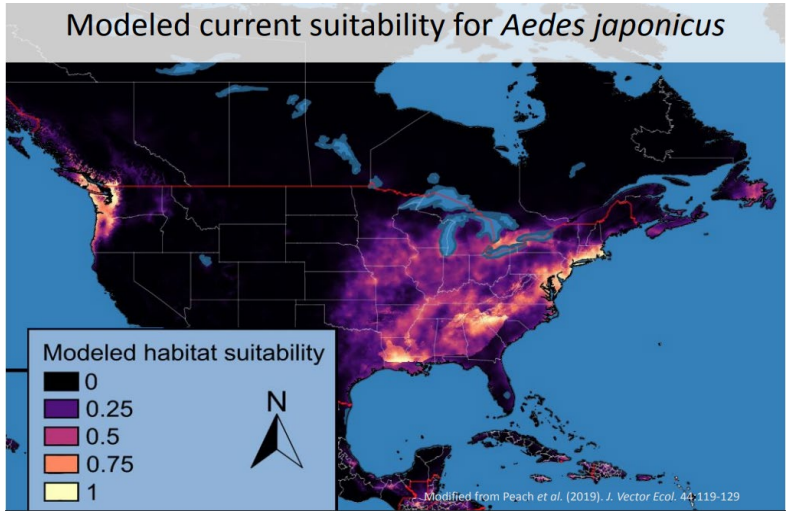
## Increasing temperature leads to…

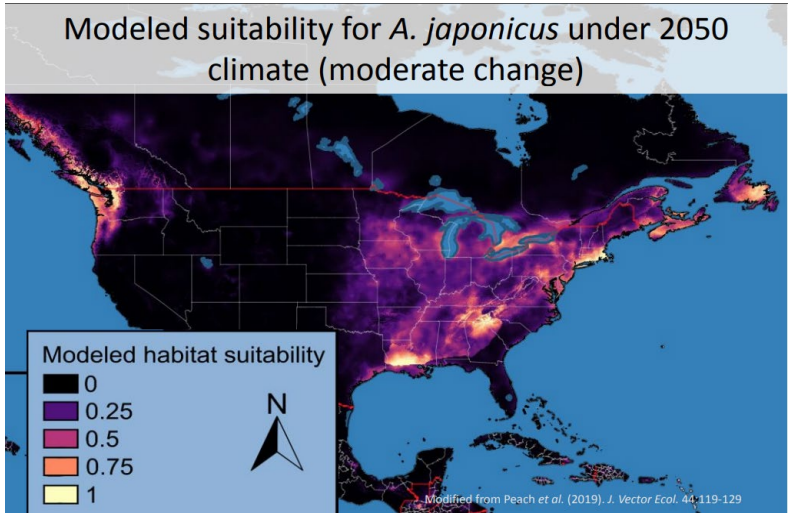
## Increased mosquito exposure

- Multiple generations per season[9]
- Mosquito habitats shifting north[9]
- Increased larval and mosquito survival[9]

## Increased CSGV transmission

- Increased vertical transmission from mosquitos to offspring (overwintering) [9]
- Increased viral replication in mosquitos and transmissibility to humans(?)



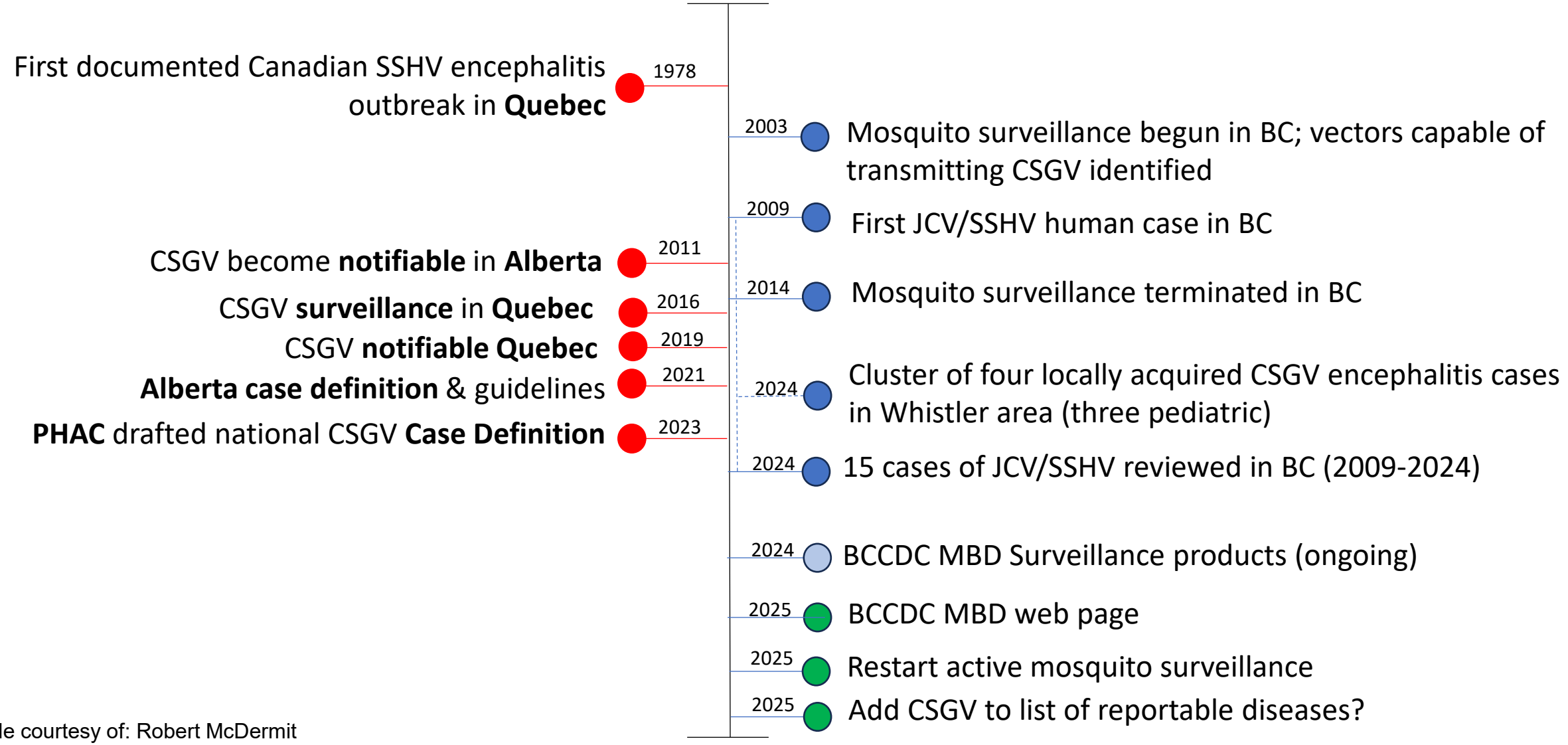

Slide courtesy of: Robert McDermit

Modeled distributions of Aedes japonicus japonicus and Aedes togoi (Diptera: Culicidae) in the United States, Canada, and northern Latin America - Peach - 2019 - Journal of Vector Ecology - Wiley Online Library

**BACKGROUND**

# Canadian Context

# BC Context

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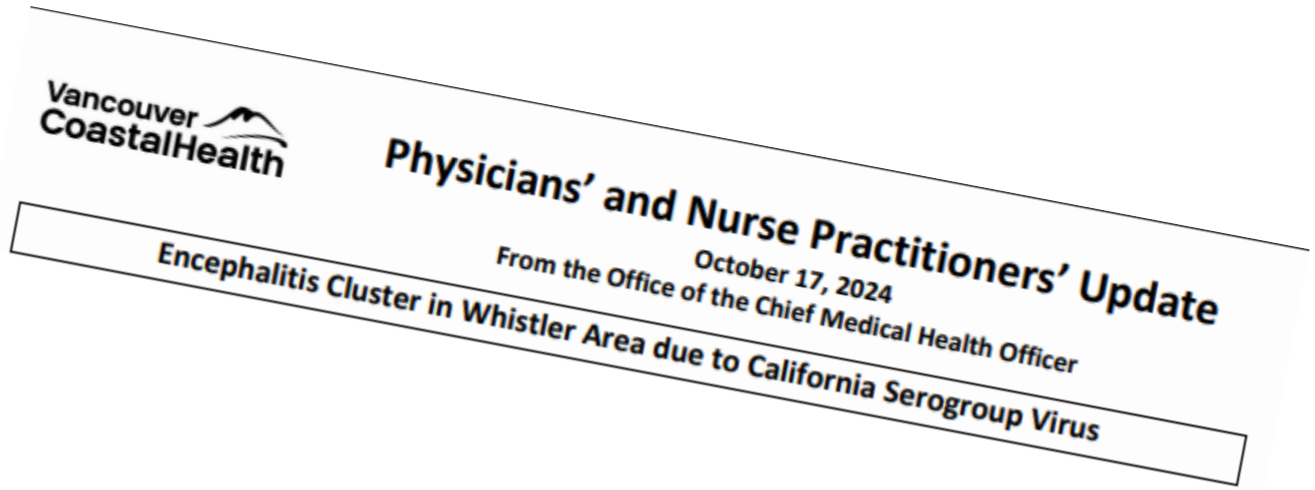
# Restarting Active Mosquito Surveillance

- Three pediatric cases of CSG viral encephalitis: August, 2024
- Residents of Whistler area


Vancouver CoastalHealth

**Physicians' and Nurse Practitioners' Update**

October 17, 2024

From the Office of the Chief Medical Health Officer

**Encephalitis Cluster in Whistler Area due to California Serogroup Virus**


News release

**New pilot project to study mosquito population in Sea to Sky region**

Vancouver CoastalHealth

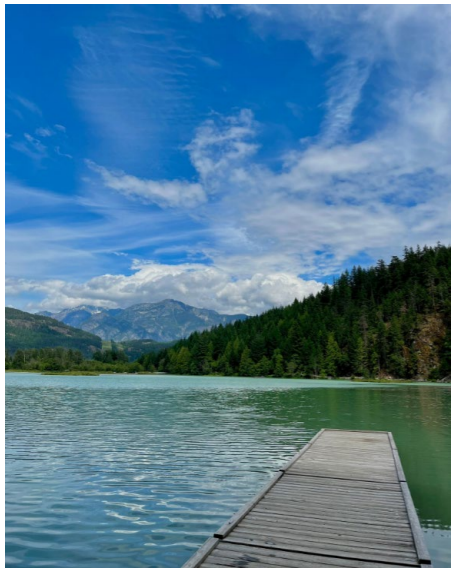
July 18 2025

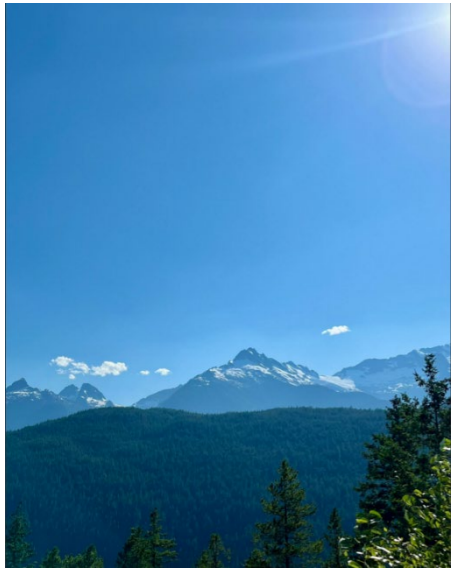
This summer, Vancouver Coastal Health (VCH) Public Health and the BC Centre for Disease Control — together with partners from Líl̓wat Nation, Squamish Nation and the University of BC — are undertaking a small-scale mosquito

# Pilot Surveillance Study

**Objectives:**

- To identify mosquito species across the region (Dept. of Zoology, UBC)
- To test identified species for select pathogens (PHL, BCCDC)
    - CSGV
    - West Nile virus (WNV)





# Field Sampling

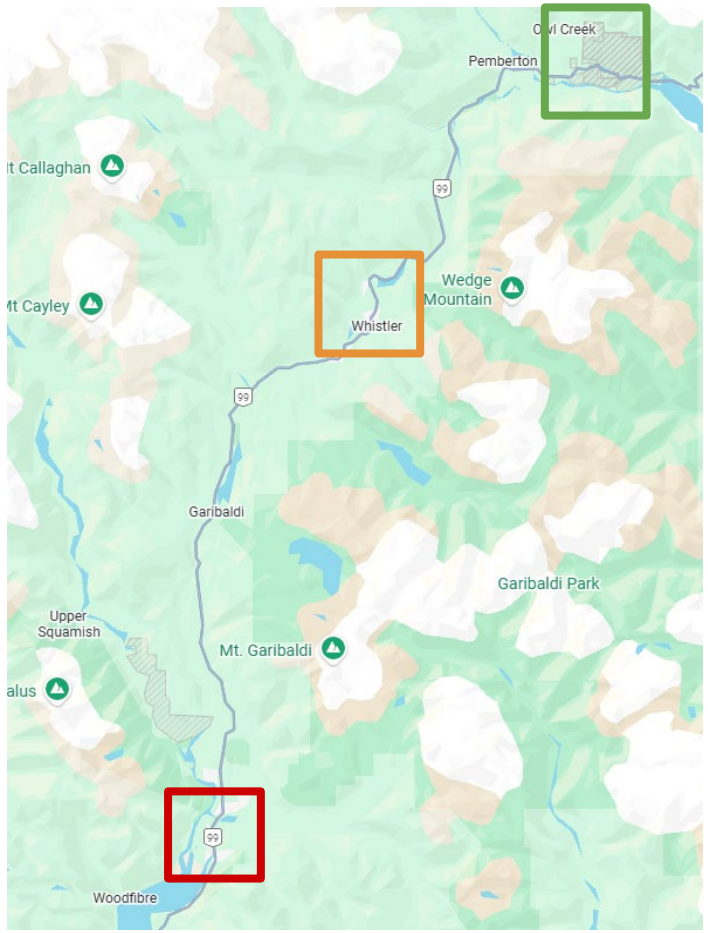
- 11 sites were selected across the Sea-to-Sky corridor
- Site selection: team recon
- Optimal mosquito-catching sites:
  - Standing water
  - Protection from elements
  - Low chance of trap disruption
- Trap set-up/collection: 24 hours

Mosquito Team Recon Trip

# Field Sampling

- 3 trap types:
  - Biogent Pro Ground Trap
  - CDC Light Trap
  - Gravid Trap

- Bait:
  - $CO_2$(Dry ice): CDC, BG Traps
  - Scent-baited Hay-brewed tea: Gravid trap




METHODS

# Laboratory Analysis

- Morphological identification of mosquito species:
- Sort bycatch
  - Canadian Journal of Arthropod Identification dichotomous key
    - BC-specific key: 51 species
- Precautions to minimize RNA degradation:
  - Ice trays
- Pooling

Canadian Journal of ARTHROPOD IDENTIFICATION

*A product of the Biological Survey of Canada & the Entomological Society of Canada*

**Key to the Genera of Adult Female Mosquitoes**

1. Scutellum rounded with setae evenly distributed (Fig. 1); palpi about as long as proboscis (Fig. 2) ..... 2


Fig. 1


Fig. 2

Scutellum trilobed with setae confined to three groups (Fig. 3); palpi shorter than proboscis (Fig. 4) ..... 3

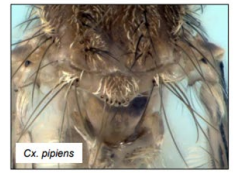



Fig. 3

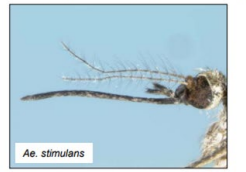
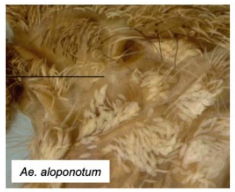



Fig. 4

10. Abdominal black with crisp white basal bands; few or no pale scales otherwise; hypostigmal area without scales (Grains)..... Aedes aloponotum





Note: Image 2 of dorsal thorax is very bright (ON species). Image 3 is BC species – still very yellow, but looks slightly darker due to lighting.

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PRELIMINARY RESULTS

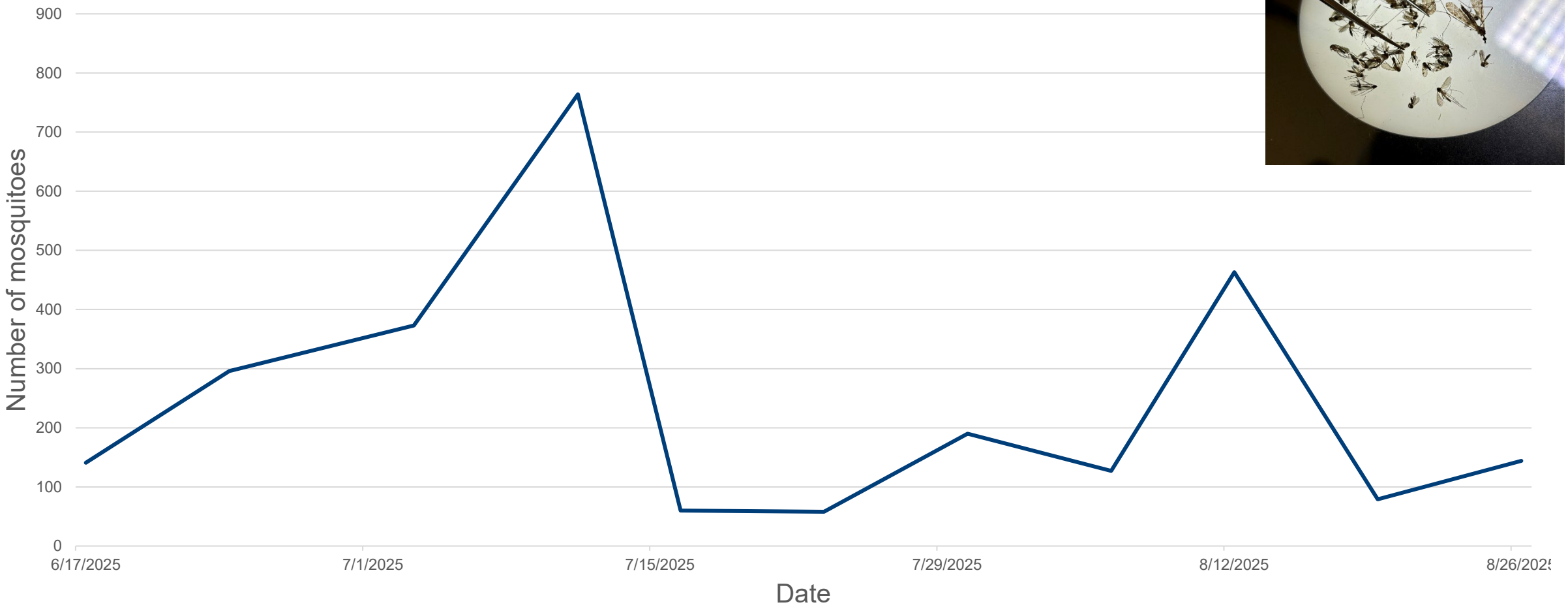
# Mosquito Species

- **2575** Mosquitoes collected and identified from June 16-Aug 25
  - 27 species found

- Regional catch count, 24hr period:
  - Largest: 764
  - Smallest: 58
  - Average: 245

**PRELIMINARY RESULTS**

# Mosquito counts by trap night

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# Notable Endemic Species

- *Aedes communis*, Ae. cinereus, Ae. excrucians, Ae. fitchii, Ae. implicatus, Ae. Intrudens, Ae. provocans, Ae. punctor, Ae. Vexans, Coquillettidia perturbans*

*Others*

- *Aedes vexans*
  - Widespread, common
  - Zika Virus, JCV, WNV[10]

- *Culex tarsalis*
  - WNV

- *Anopheles punctipennis*
  - Malaria

Aedes Vexans

Anopheles Freeborni

# Notable Invasive Species

- *Aedes japonicus:*
  - 6th record in BC
  - Competent vector of: WNV, La Crosse virus*, Japanese encephalitis*, Cache Valley virus
  - Competent under lab conditions: Eastern equine encephalitis, St. Louis encephalitis (SLE), Rift Valley Fever*, Zika*, Dengue*, Chikungunya*[11]

- *Culex pipiens / restuans*
  - Competent vector of: WNV, SLE[12]

*Aedes japonicus*

*Culex Pipiens*

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*Not currently found in Canada

# Next Steps

- Pathogen test results - pending
- Application for 2nd year of surveillance in same region
  - Establishment of *Ae. japonicus* and continued surveillance of mosquito-borne pathogens
  - Expansion: more populated North Shore region
  - Pediatric serosurvey

# Acknowledgements

**Project Funder:** UBC CDC Strategies Initiatives STARTS Grant Program

**Project Partners:**

Lílwat Nation

Sḵwx̱wú7mesh Úxwumixw
Squamish Nation

Vancouver CoastalHealth

UBC

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# Questions?

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