

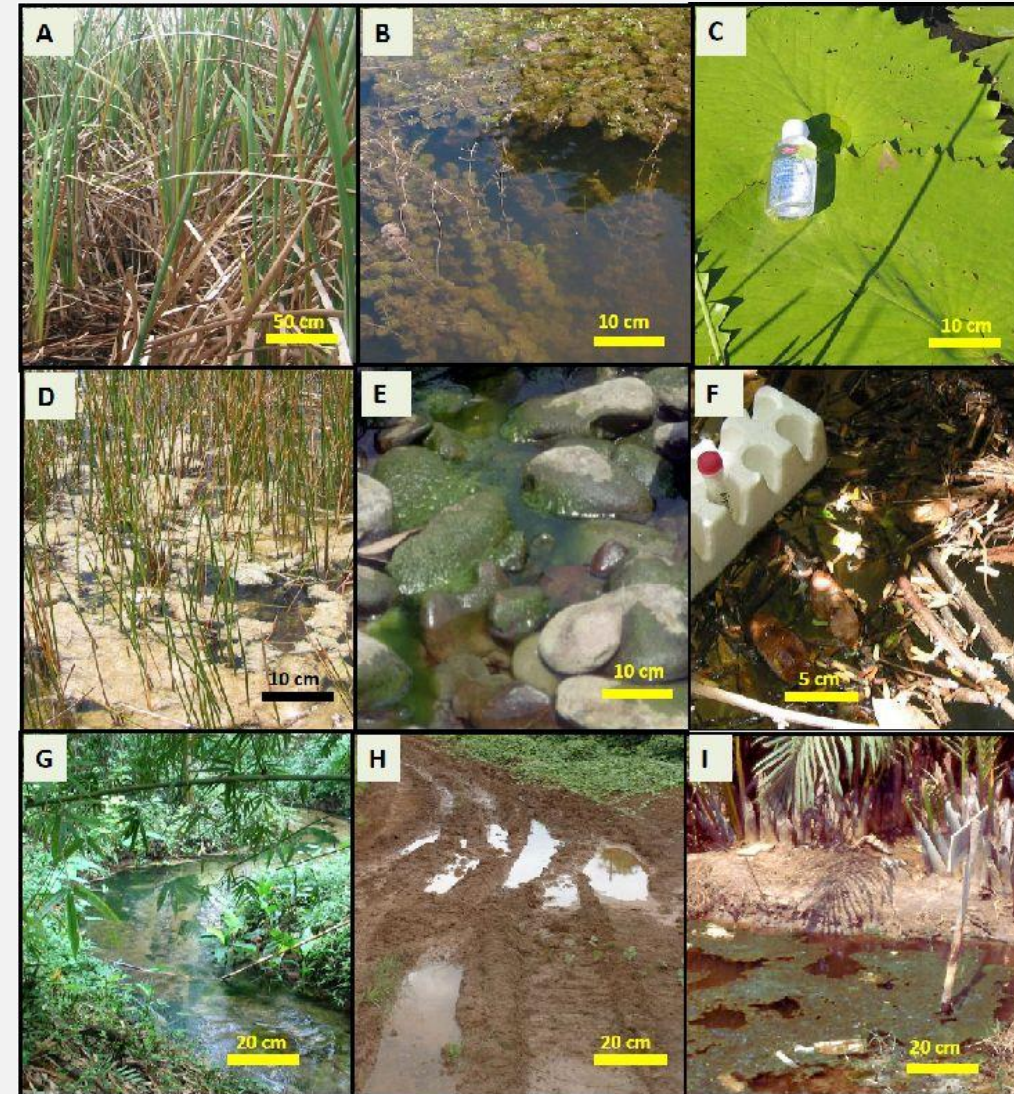
METHODS OF MOSQUITO BIOCONTROL AND INCIDENCE OF WNV IN THE NEOTROPICS



Adrian Vasquez, PhD
Mercer University
Macon, Georgia
vasquez_aa@mercer.edu

INTEGRATED PEST MANAGEMENT

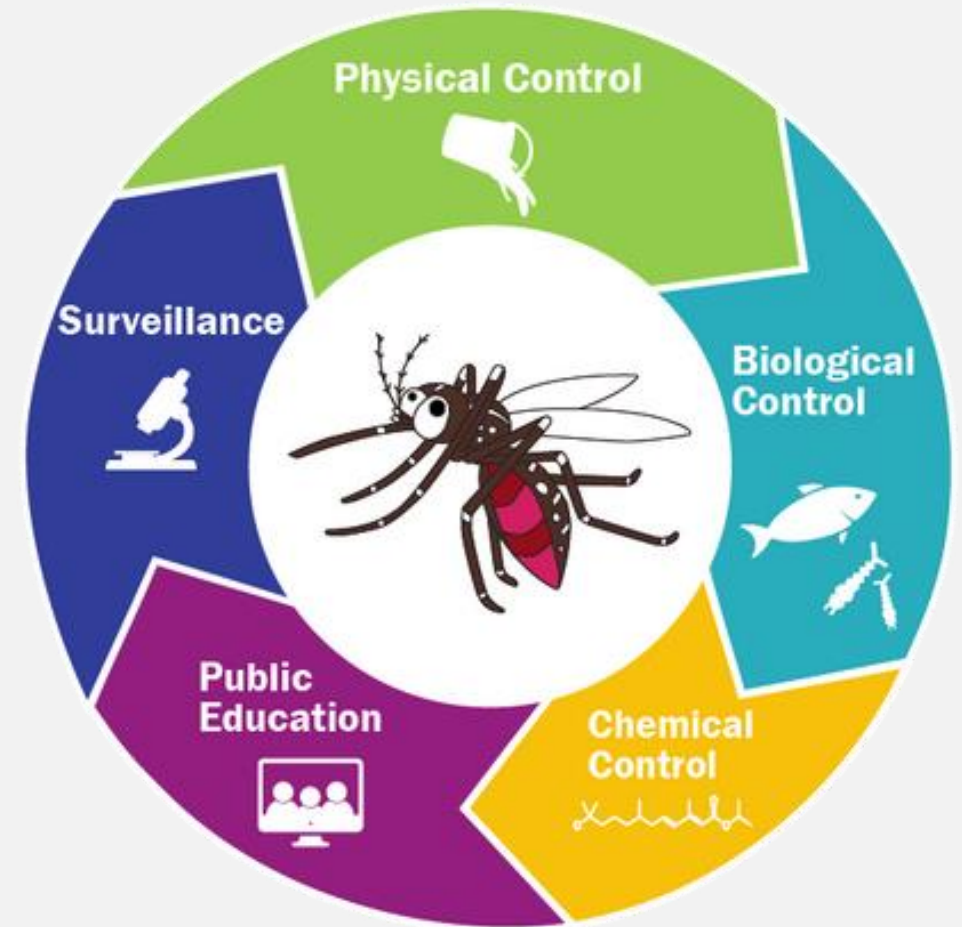
- Mosquitoes can live and reproduce in a variety of environments. These can be mangrove swamps, salt marsh, salt ditch, freshwater marshes, freshwater lake, Ponds and seepage areas, springs, swamps and canals.
- Mosquitoes can breed in the most strange places such as used tires, plastic containers, tree holes, flood water pool, moist leaves, crab holes, making them difficult to eradicate. Integrated pest approach means using both chemical and biological means to eradicate mosquitoes.



Rejmankova et al. 2013. Ecology of Larval Habitats

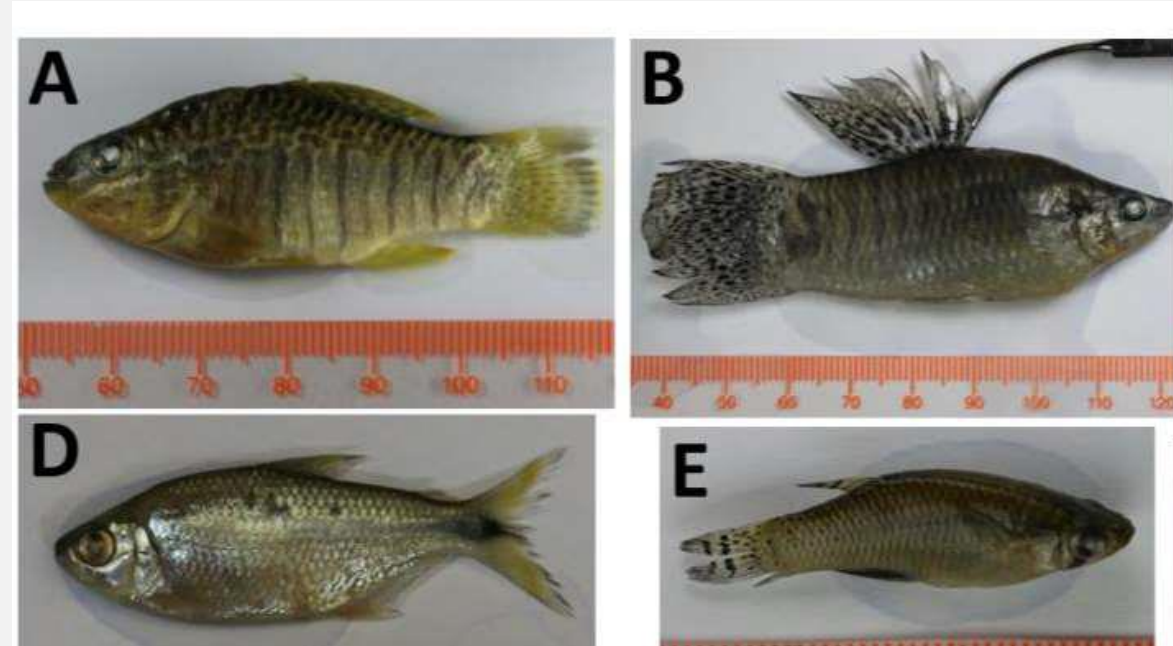
INTEGRATED PEST MANAGEMENT

- IPM helps with habitat conservation and prevention of pesticide resistance
- I will give a few examples of biocontrol options



BIOCONTROL OF MOSQUITOS

- In the ecological food web there are many parasites and predators of mosquitoes
- For example:
- Plants, Fungi, Bacteria
- Diverse parasites
- Predators such as fish, birds, bats and invertebrates like the copepods and water mites

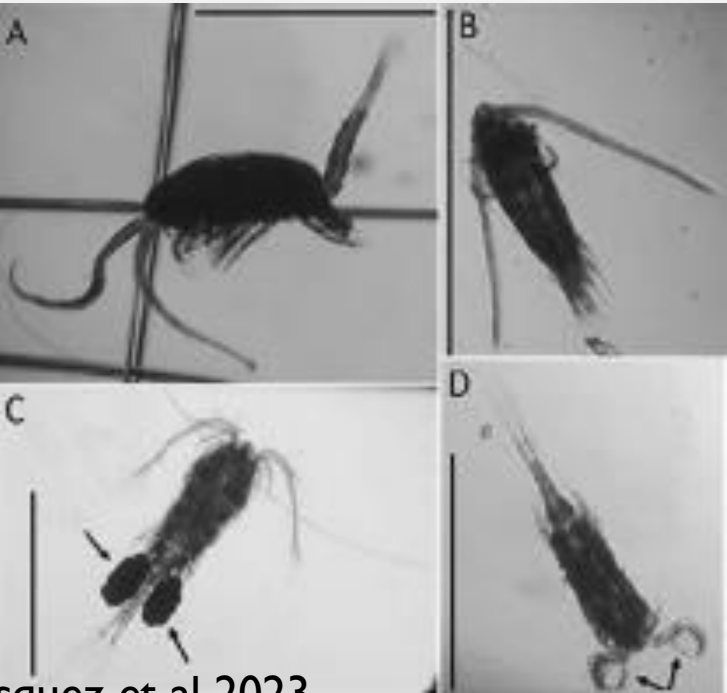


Diversity of freshwater fish from Belize.
Vasquez et al 2023.

PREDATORS OF MOSQUITOS

- Water mites, copepods, chironomids, hydra and even the larvae of other mosquitoes are predators

Copepods of the Great Lakes



Vasquez et al 2023



[SpongeBob SquarePants](#)

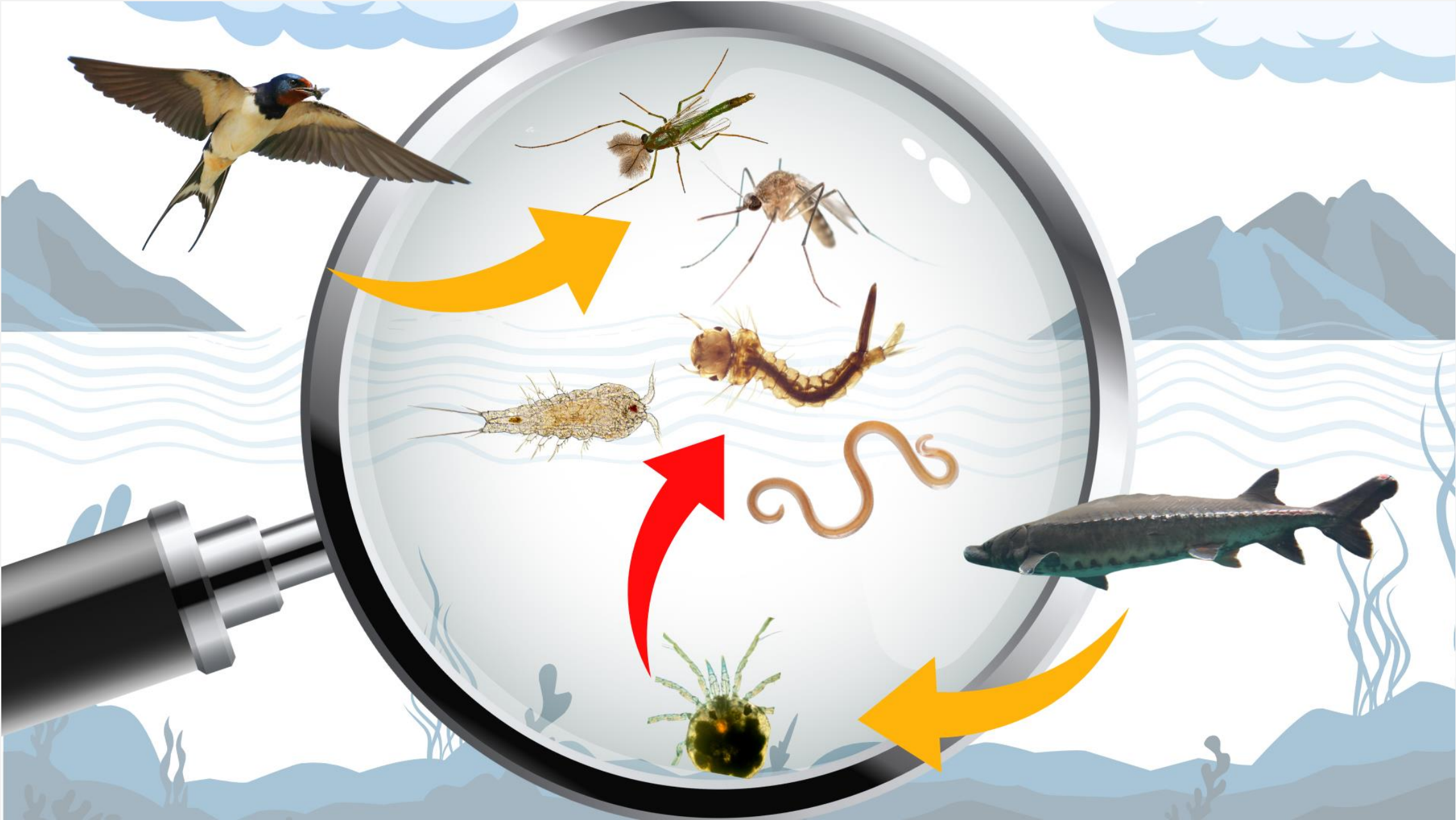
Hydra



Chironomidae

Creative commons image Flickr and Ram Lab

THE ECOLOGY OF FRESHWATER HABITATS



WATER MITE PARASITIZING MOSQUITO



Damselfly

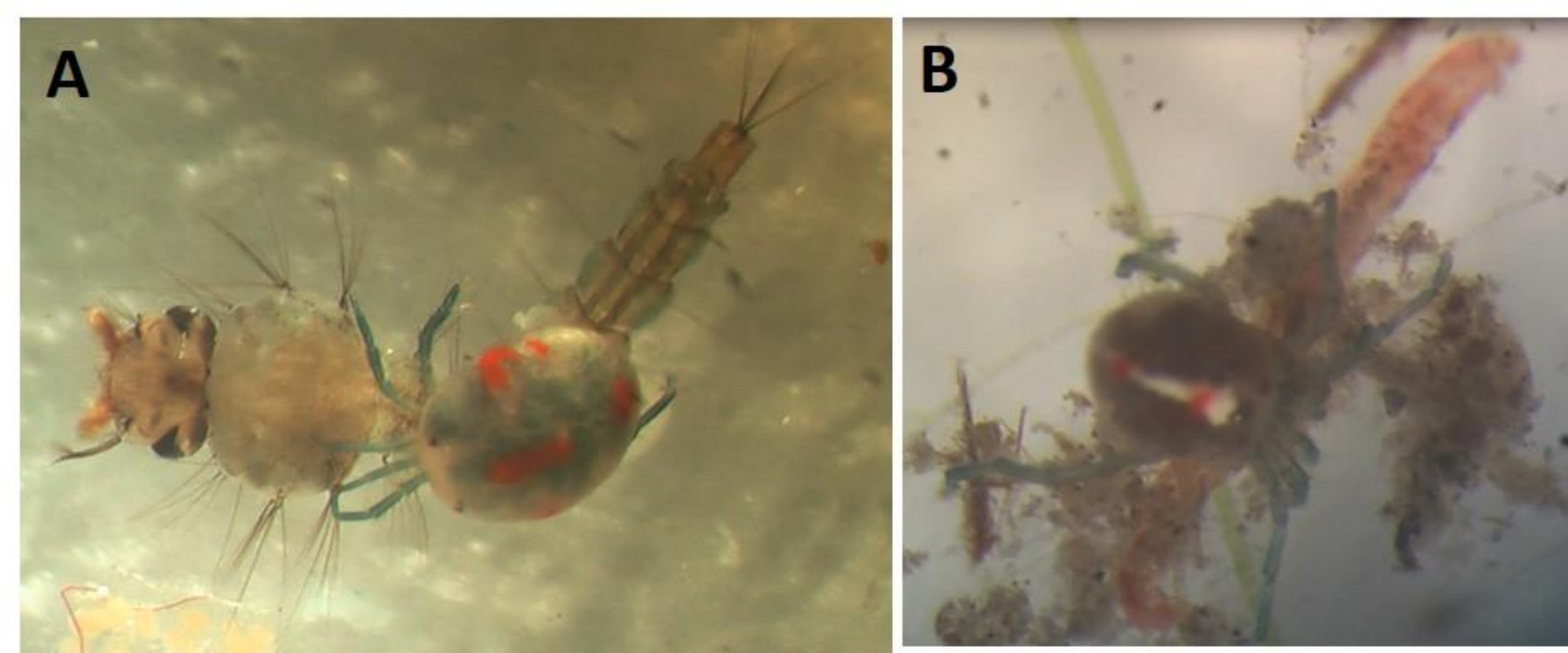


Research Gate Image

Water mites are predators of diverse prey

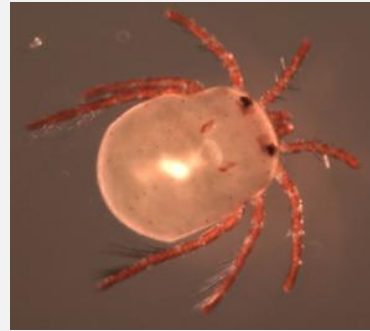
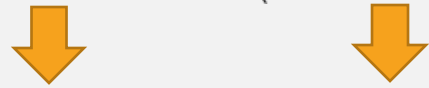
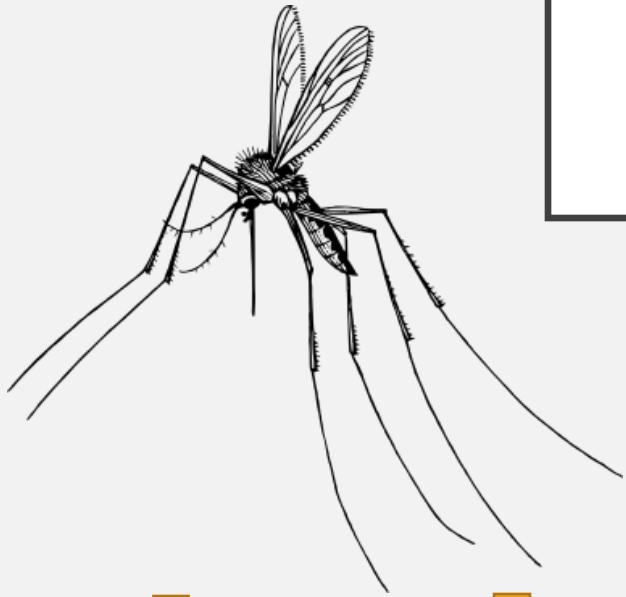


DNA analysis of water mite stomach contents

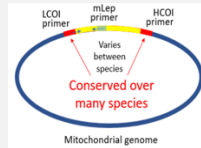
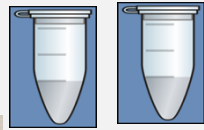


Predator	Prey	Match of PCR product (mLep) on GenBank. Query and ID%.
<i>Lebertia</i>	<i>C.pipiens</i>	<i>C. pipiens</i> Q: 100% & ID: 99%
<i>Lebertia</i>	<i>C. pipiens</i>	<i>C. pipiens</i> Q: 100% & ID: 99%
<i>Lebertia</i>	<i>C. pipiens</i>	<i>C. pipiens</i> Q: 98% & ID: 99%
<i>Lebertia</i>	Chironomid	Chironomidae sp. Q:100 % & ID: 97%
<i>Lebertia</i>	Chironomid	<i>Cricotopus</i> sp. Q: 99% & ID: 97%

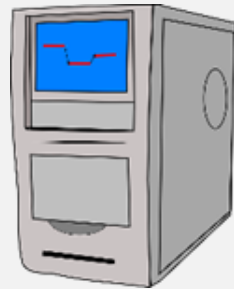
DNA BARCODING AND NEXT GENERATION SEQUENCING



Primer design
and DNA
extraction



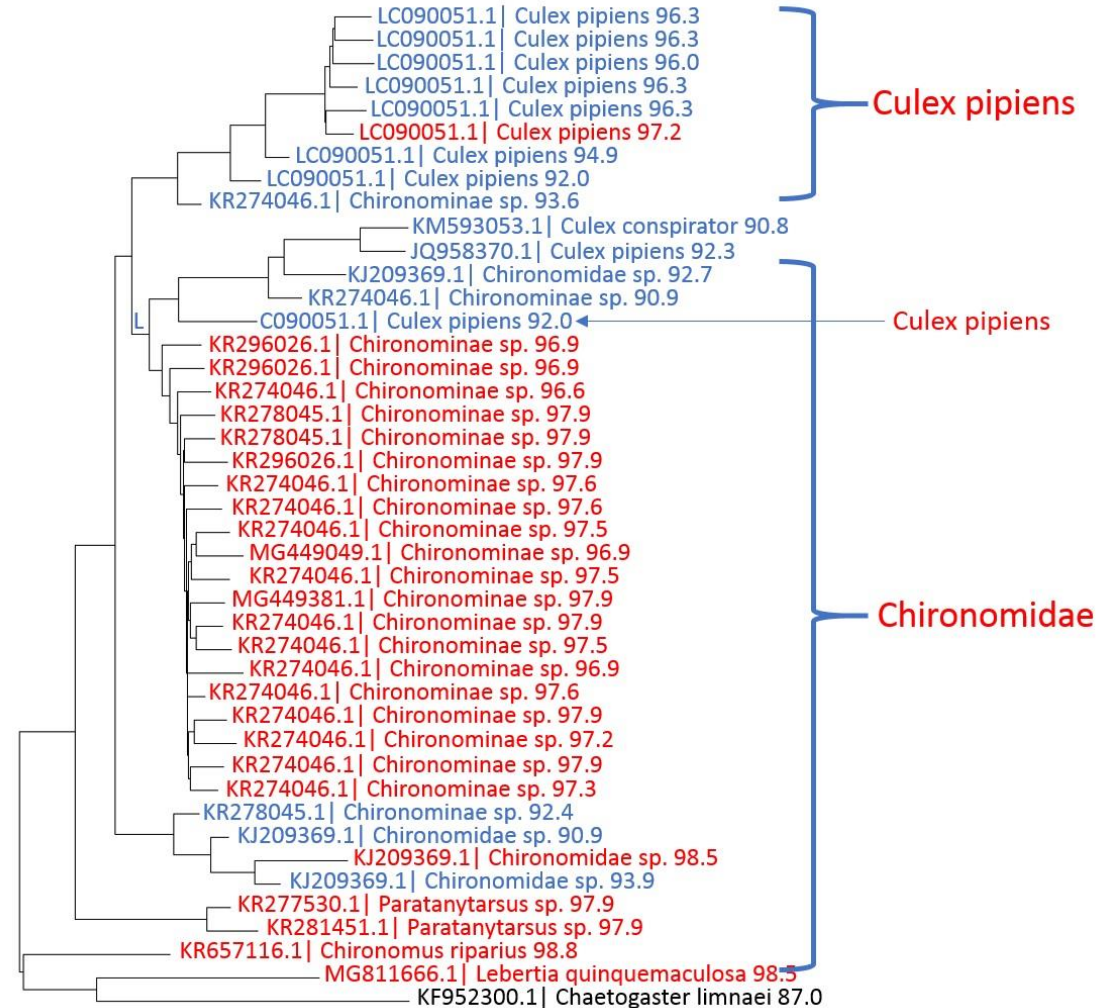
PCR
And next gen
sequencing



MEGA



Bioinformatics



Vasquez et al. 2021. Water mite diets reveal prey biodiversity. *PLOS One*.

RELEVANCE AND PRACTICAL APPLICATION?

- **DNA barcoding provides a tool to assist with taxonomy**
- **Its been a good basis of collaboration**
- **A good basis for discovery**

international
BARCODE
OF LIFE










What about the biting midge?

ZooKeys 1208: 133–163 (2024)
DOI: 10.3897/zookeys.1208.24495

Research Article

New species and a fascinating diversity of Chironomidae (Diptera, Insecta) in and around an overlooked urban vernal pool

Armin Namayandeh^{1,2}, Sergio Guerra², Natasha Islam², Taylor James², Patrick L. Hudson³, Edris Ghaderi^{4,5}, Thameena Yusuf², Adrian A. Vasquez⁶, Jeffrey L. Ram⁷



Dr. Elías Gutiérrez

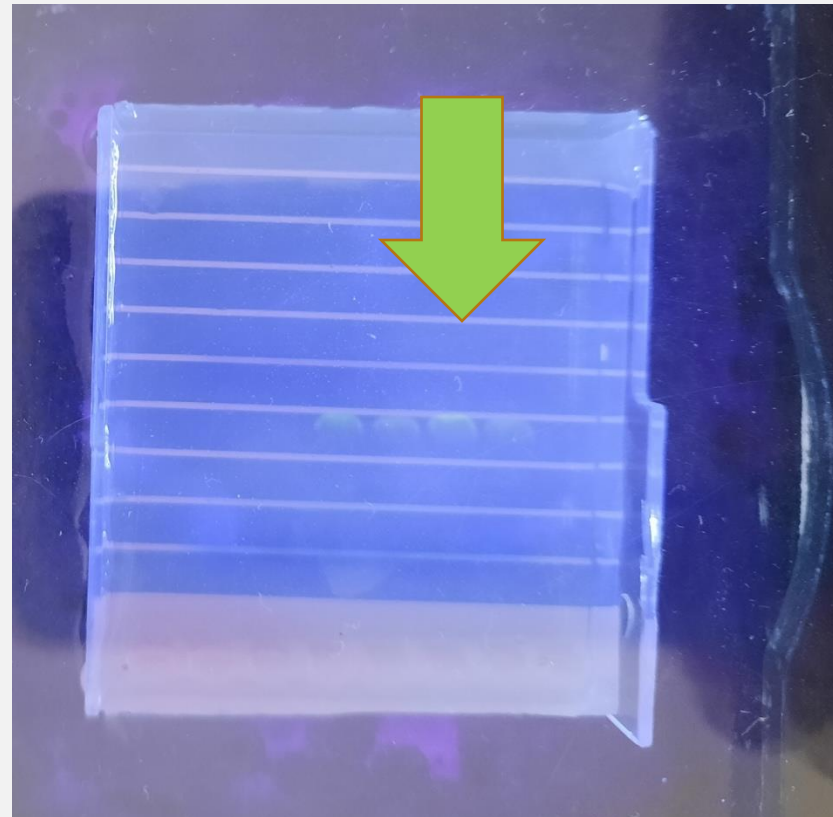


FULBRIGHT: SURVEY AND DISEASE MONITORING OF MOSQUITOES FROM BELIZE

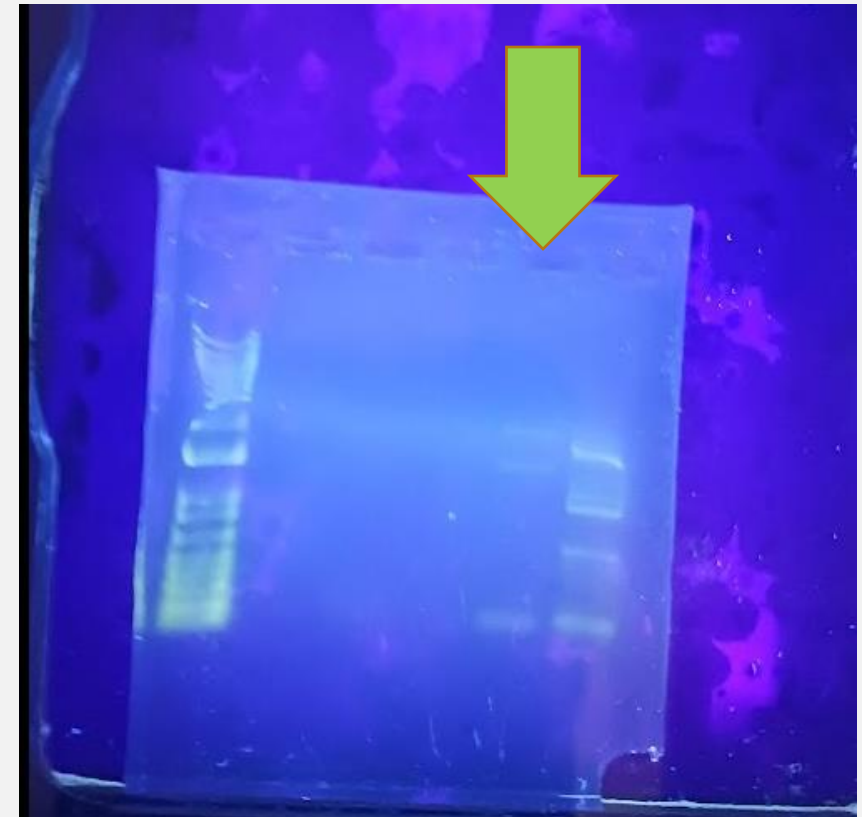


RESULTS: CAPTURE, IDENTIFICATION AND PATHOGEN DETECTION

DNA barcoding to assist with identification



Identification of heartworm parasites in mosquitoes



WEST NILE VIRUS IN LATIN AMERICA PRESENTS INTERESTING AND UNUSUAL EPIDEMIOLOGY

Why are there no human West Nile virus outbreaks in South America?

Camila Lorenz,* and Francisco Chiaravalloti-Neto

Department of Epidemiology, School of Public Health, University of São Paulo, São Paulo, Brazil

More than two decades have passed since the West Nile virus (WNV) arrived in the Americas. After its first detection in New York City in 1999, it spread rapidly across North America, causing human and animal outbreaks. The most intense outbreaks occurred approximately

other mosquito-borne arboviruses that cause similar clinical symptoms. Infection may be misdiagnosed as chikungunya, Zika, Mayaro, dengue, or malaria. Other

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out-
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The Lancet Regional Health - Americas

2022;12: 100276

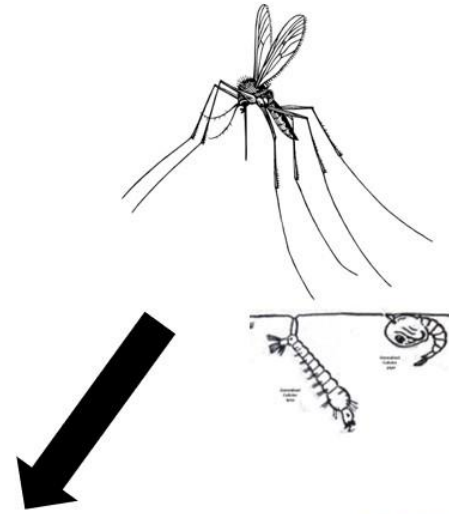
Published online 19 May 2022

<https://doi.org/10.1016/j.lana.2022.100276>

RESULTS

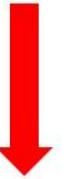
- So far, West Nile virus has not been detected in Belize.
- Approximately 10 samples analyzed from 500 mosquitoes collected during my Fulbright months in Belize.
- In addition, PCR was used to locate a more common parasite, dog heartworm (*Dirofilaria immitis*).
- Teaching and training Belizean scientists and students on molecular methods for the study of disease and biodiversity.

**ONE HEALTH:
IDENTIFYING
ECOSYSTEM SERVICES
FROM MAN-MADE
URBAN AQUATIC
HABITATS.**



Collect mosquitoes from green stormwater infrastructure and natural areas

Identify species



Test for West Nile



Collect mosquitoes after extreme weather event and compare West Nile prevalence



THANKS TO MY COLLABORATORS!

Undergraduates:

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- Brittany Bonnici
- Mario McGhee
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- Nicole Farley
- Dr. Jorge Trejo
- Dr. Joseph Dunbar
- Dr. Carol Miller
- Dr. Jeffrey Ram
- Dr. Marcus Zervos
- Ms. Karen Bautista
- Dr. Victor Carmona.....

Too many to name!

Email: vasquez_aa@mercer.edu



University of Belize



Education Empowers a Nation



WAYNE STATE UNIVERSITY
SCHOOL OF MEDICINE



QUESTIONS?



The Sittee
River