FKMCD-Oxitec Public Educational Webinar

Environmental Health and Oxitec: Benefits for the Florida Keys' Sensitive Ecosystem and Endangered Species

30 September 2020

FLORIDA Mosquito Control DISTRICT KEYS

OXITEC

Introductions – Panelists With You Today

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FKMCD-Oxitec Public Educational Webinar Series

FKMCD and Oxitec are hosting a series of public educational webinars to share information with residents of the Florida Keys and provide forums to answer questions.

- All webinars are open to everyone
- All webinars are recorded and made available for everyone after the event
- All questions will be answered (some in batches if questions are similar)
- If time runs out, we will accept questions in writing via florida@oxitec.com
- Questions and answers will be published in writing after the event with external or related online resources/references

Upcoming:

1. **Human Health and Oxitec**: The Safety of Oxitec Technology – coming in October!
2. **Virtual Tour: Inside Oxitec Labs** – coming in November! *Meet the team that produces mosquitoes for the project and see inside one of Oxitec's production facilities in a virtual tour.*
3. **What's in the Box?: How Oxitec's Just-Add-Water Technology Helps Control the *Aedes aegypti* Population** – coming in December!

Florida Keys & Oxitec Public Educational Webinars

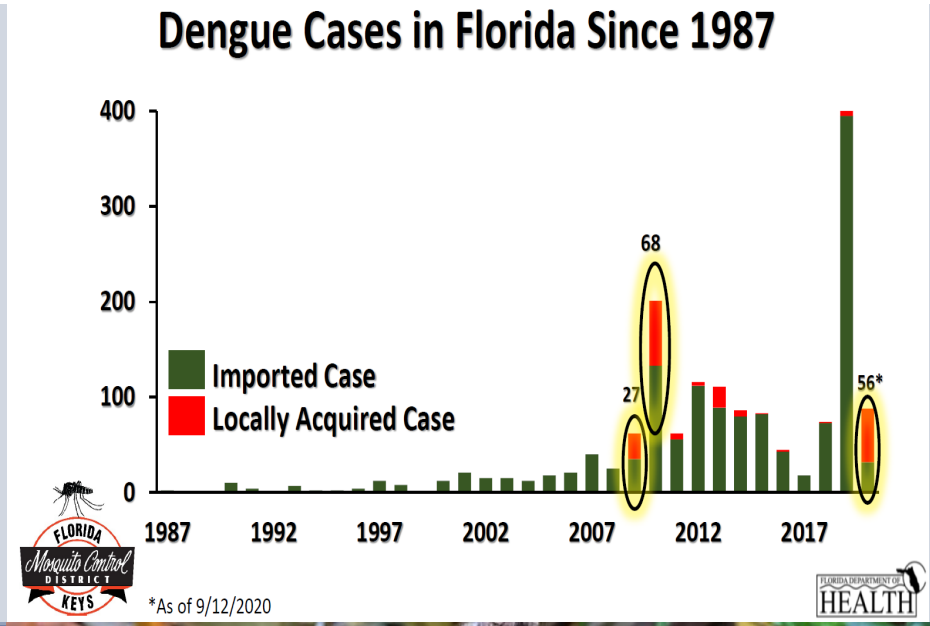
Welcome to webinar #1 in this 7-part series!

Today's Agenda:

- Why now? Health, economy and the environment.
- The spread of the invasive, disease-carrying *Aedes aegypti* mosquito.
- Insecticide resistance.
- Benefits of Oxitec's targeted biological control solution.
- Regulatory findings.
- Your questions, answered.

Why now? – Health, Economy, and the Environment

- Dengue is an ongoing challenge with over 50 confirmed locally-acquired cases in Monroe County so far in 2020
- The threat of other diseases such as Zika, chikungunya and yellow fever persists
- Insecticide resistance in local mosquitoes
- Need more tools in our toolbox

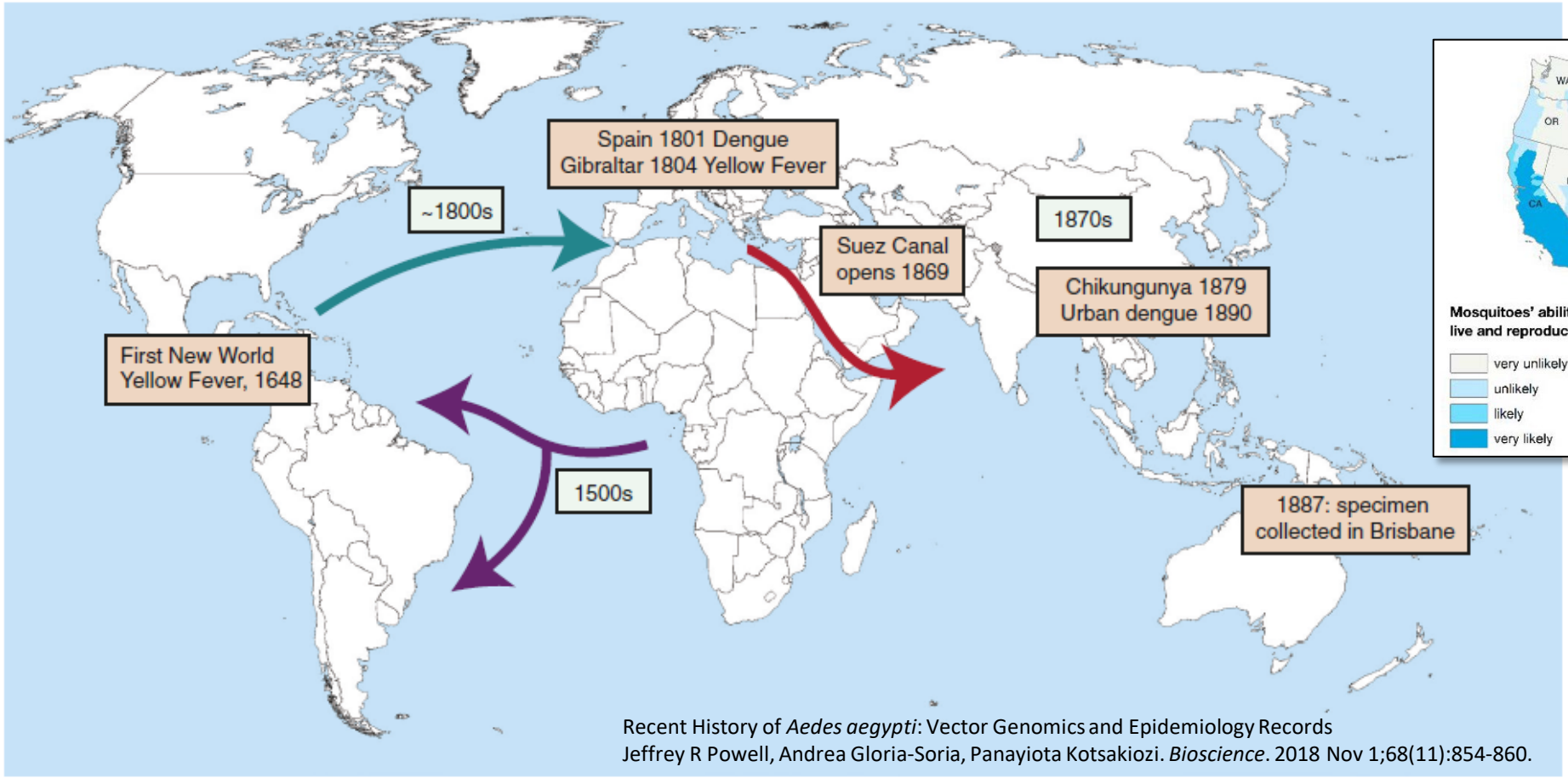


- Environmental impact is a major consideration
- Using species-specific tools minimizes environmental impact
- Nine national and state agencies concluded Oxitec male mosquitoes pose no risk to environmental health

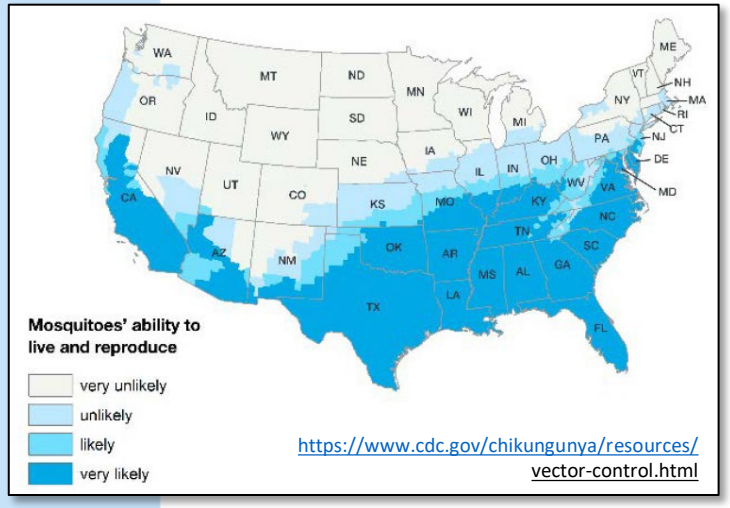
Endangered Schaus' swallowtail butterfly lives where the current dengue outbreak is.

The *Aedes aegypti* Mosquito*:* an Invasive Species in Florida

***Aedes aegypti* is not native to the Americas.** It was most likely transported from Africa by Portuguese ships sometime in the 16th century.



Recent History of *Aedes aegypti*: Vector Genomics and Epidemiology Records
Jeffrey R Powell, Andrea Gloria-Soria, Panayiota Kotsakiozi. *Bioscience*. 2018 Nov 1;68(11):854-860.

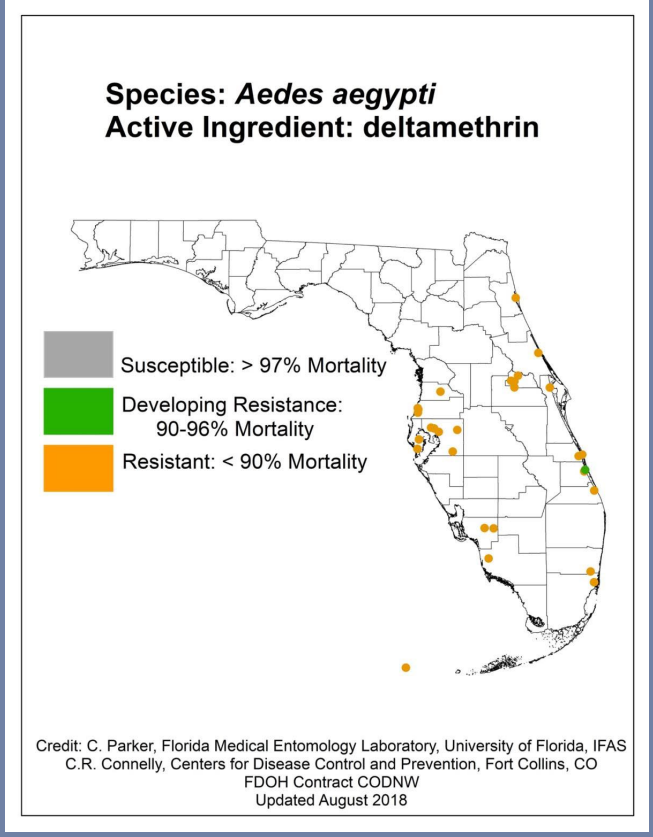


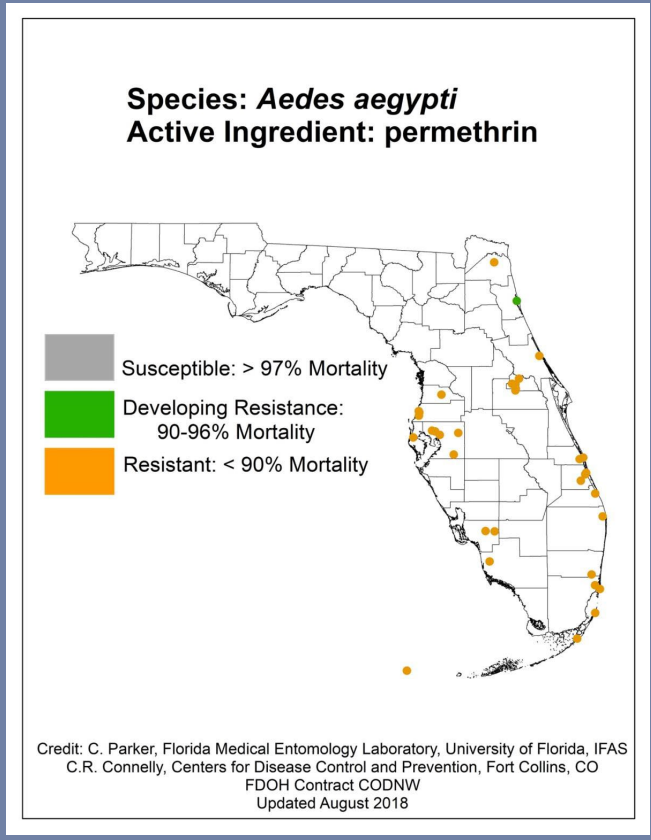
Aedes aegypti in Florida and surrounding U.S. states today.

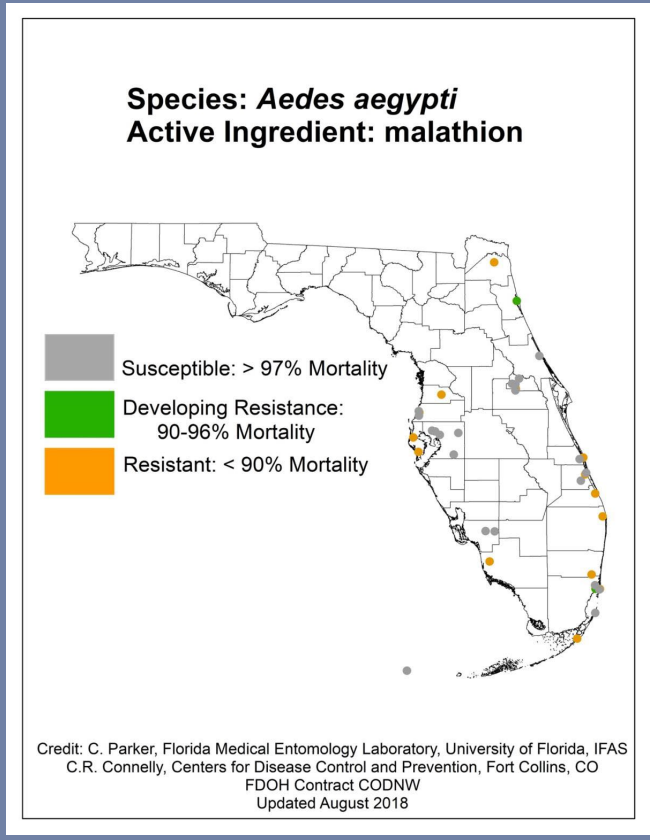
Wild *Aedes aegypti* Mosquitoes: Becoming Resistant To Insecticides

Chemical insecticide resistance is a major challenge for *Aedes aegypti* control in the United States.

Resistance could worsen, which means new tools need to be developed proactively now.







*Final Report: Florida Department of Health Contract CODNW. *Updated distribution and insecticide susceptibility status of container mosquitoes in Florida, 14 Aug 2018.*

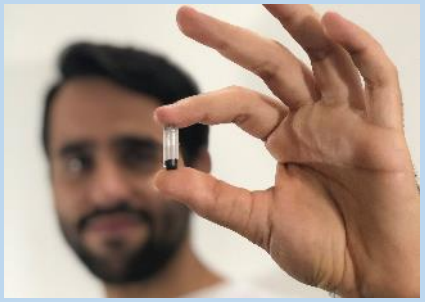
Oxitec's *Aedes aegypti* Mosquito Technology ("OX5034")

OXITEC'S *AEDES AEGYPTI*

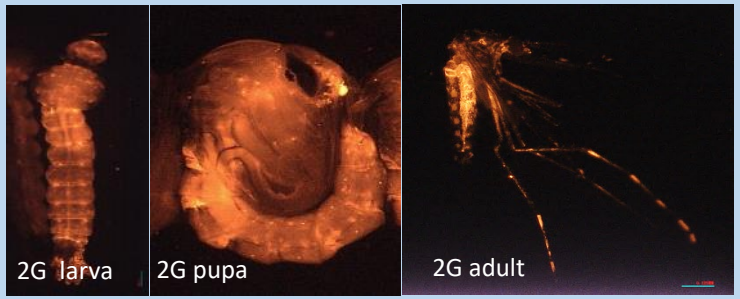
- ✓ TARGETED SUPPRESSION
- ✓ SAFE, NON-TOXIC, NON-ALLERGENIC
- ✓ PROVEN EFFECTIVENESS

- ✓ MALE-ONLY RELEASES (male mosquitoes do not bite)
- ✓ TRACEABLE IN THE FIELD
- ✓ SELF-LIMITING IN THE ENVIRONMENT

- No females produced
- Low-tech, egg-based devices enabled



- Easy track-and-trace in the field
- Non-toxic, non-allergenic



Environmental Benefit - Sustainability

- **OX5034 is a biological mating-based tool - there are no chemicals.**
- **OX5034 is not prone to resistance development.**
- **OX5034 can be integrated with other tools, maintaining effectiveness through a multi-faceted approach.**

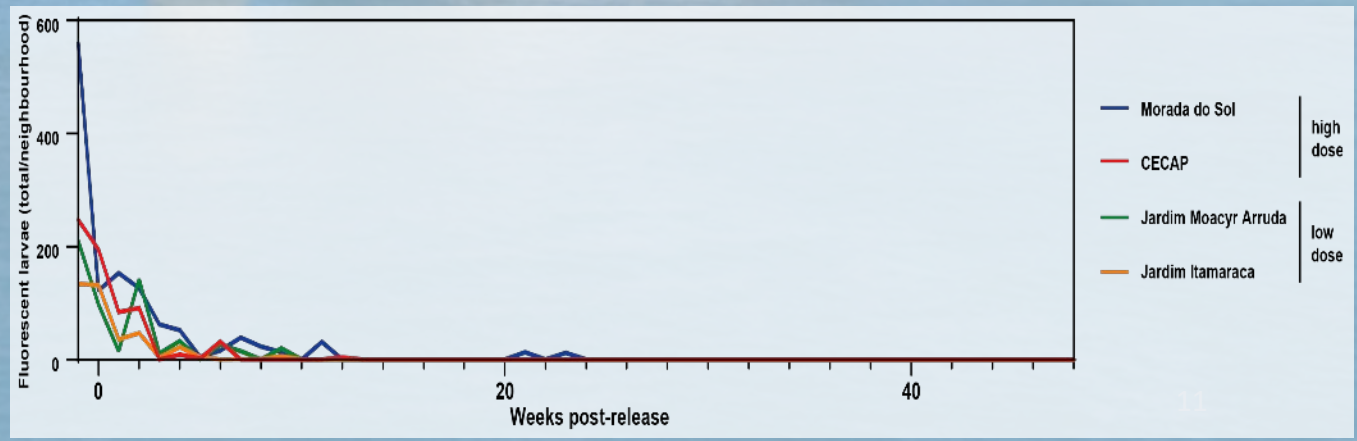
https://en.wikipedia.org/wiki/Anaea_troglodyta#/media/File:Cuban_red_leaf_(Anaea_troglodyta_cubana)_male.JPG

Environmental Benefit - Reduced Reliance on Chemicals

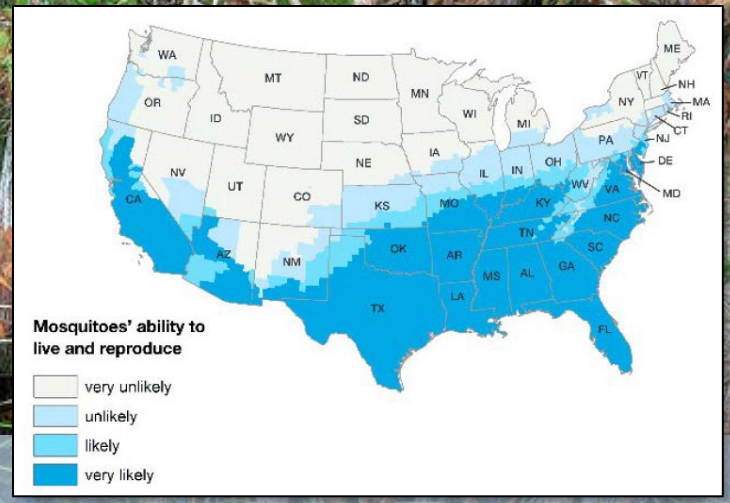
- Integrated Vector Management (IVM)
- Reducing reliance on insecticides
- Innovative tools
- OX5034 has the potential to reduce insecticide resistance

Environmental Benefit - No Ecological Footprint

- No direct nor indirect effects on other animals, humans or the environment.
- The introduced genes cannot persist, and disappear within a few generations.
- Over 1 billion Oxitec mosquitoes released over the past decade with no negative impact.



Environmental Benefit - Restoring Native Ecology and Habitat



- Native ecology in the US does not include *Aedes aegypti*, which is an invasive species.
- As an invasive species, *Aedes aegypti* has the potential to impact and maybe even displace native biodiversity.
- OX5034 mosquitoes are designed to control *Aedes aegypti* while protecting native species.

https://en.wikipedia.org/wiki/Everglades_National_Park#/media/File:Cypres_dome_with_Alligator,_NPSphoto,_G.Gardner_(9101883836).jpg

The Florida Keys' Sensitive Ecosystem

Protected Species in the Florida Keys (excluding plants and fish)

Birds:

- Everglade snail kite
- Cape Sable seaside sparrow
- Wood stork
- Audubon's crested caracara
- Piping plover
- Roseate tern
- Red knot
- Florida grasshopper sparrow
- Florida scrub-jay

Mammals:

- Key deer
- Florida panther
- Silver rice rat
- Key Largo cotton mouse
- Key Largo woodrat
- Lower Keys marsh rabbit
- Puma
- Florida bonneted bat

Reptiles, Insects and Molluscs:

- American alligator
- Hawksbill sea turtle
- Leatherback sea turtle
- Loggerhead sea turtle
- Eastern indigo snake
- American crocodile
- Gopher tortoise
- Schaus' swallowtail butterfly
- Miami blue butterfly
- Bartram's hairstreak butterfly
- Florida leafwing butterfly
- Stock Island tree snail

US Fish and Wildlife: https://ecos.fws.gov/ecp/report/species-listings-by-current-range-county?fips=12087

EPA Conclusion: Oxitec Mosquitoes are Safe for Wildlife and the Environment

<u>Independently validated</u>: no effects on endangered species or critical habitat, whether direct (e.g. in diet) or indirect (if *Aedes aegypti* population reduced).

SAFE FOR

- **Fish**
- **Birds**
- **Mammals**
- **Plants**
- **Invertebrates**
- **Reptiles**
- **Other aquatic animals**

'Aedes aegypti is a negligible part of bird, amphibian or bat diets'

'OX5034 male mosquitoes cannot bite people or wildlife'

- For example, experiments by third-party independent labs showed that **<u>freshwater fish</u>** and **<u>invertebrates</u>** consuming a diet of 70% OX5034 mosquito larvae fared no differently from fish and invertebrates fed 70% non-GM mosquito larvae.






EPA Evaluation of Environmental Impact

Topic	EPA's Response
❑ Tetracycline	✓ *"**negligible risk** that testing of OX5034 mosquitoes would spread antibiotic resistant bacteria in the US environment"* (p75-76, Response to Comments)
❑ Off-target Impacts	✓ *"no adverse effects are anticipated for nontarget organisms as a result of the experimental permit to release OX5034 mosquitoes"* (p 49, EPA Human Health and Environmental Risk Assessment)
❑ Endangered Species	✓ *"a 'No Effect' determination is also made for direct and indirect effects to federally listed endangered and threatened species, and for their designated critical habitats"* (p 49, EPA Human Health and Environmental Risk Assessment)
❑ GM mosquito survival in the environment	✓ *"introgression of OX5034 strain genetics into the local wild Ae. aegypti mosquito population is likely to occur during releases of OX5034; however, the risk resulting from such introgression is negligible"* (p134, Response to Comments)

State of Florida Departments/Bureaus Unanimously Approved Permit

EUP Approved By:

- ✓ Florida Department of Agriculture and Consumer Services
- ✓ Florida Department of Environmental Protection (FDEP)
- ✓ Florida Fish and Wildlife Conservation Commission (FWC)
- ✓ Bureau of Inspection and Incident Response (BIIR)
- ✓ Florida Department of Health (DOH)
- ✓ Bureau of Agricultural Environmental Laboratories (BAEL)
- ✓ Bureau of Chemical Residue Laboratories (BCRL)
- ✓ Bureau of Scientific Evaluation and Technical Assistance, Scientific Evaluation Section (SES)

Summary

- An increasing threat is evident, disease cases increase with reducing options for management.
- OX5034 non-biting male mosquitoes are highly targeted, ensuring absolutely minimal impact on any other species or the wider environment.
- While locally-found wild *Aedes aegypti* are increasingly resistant to insecticides, OX5034 male mosquitoes have the potential to reduce reliance on insecticides for *Aedes aegypti* control.
- Protecting against a dangerous invasive species may promote native biodiversity.
- Sustainability requires long-term performance with no long-term impact on the environment, OX5034 holds the potential to provide that.

Question and Answers

Any and all questions on this evening's topics are welcome!

(If we run out of time tonight, email florida@oxitec.com and we will attempt to answer your question if it isn't included in the growing FAQ or post-event summary we publish online at oxitec.com/florida)

Conclusion

THANK YOU!

A summary of this event, as well as more Q&As, resources, facts, and background materials are available at www.oxitec.com/florida.