FKMCD-Oxitec Public Educational Webinar #4

Oxitec's Vector Control Performance – Past, Present and Future

11 August 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:

Webinar 5: Assessment, Oversight, and Validation Monday, August 17th, 5:00 – 6:00 p.m. ET

Florida Keys & Oxitec Public Educational Webinars

Welcome to Webinar #4 in this 5-part series!

Today's Agenda:

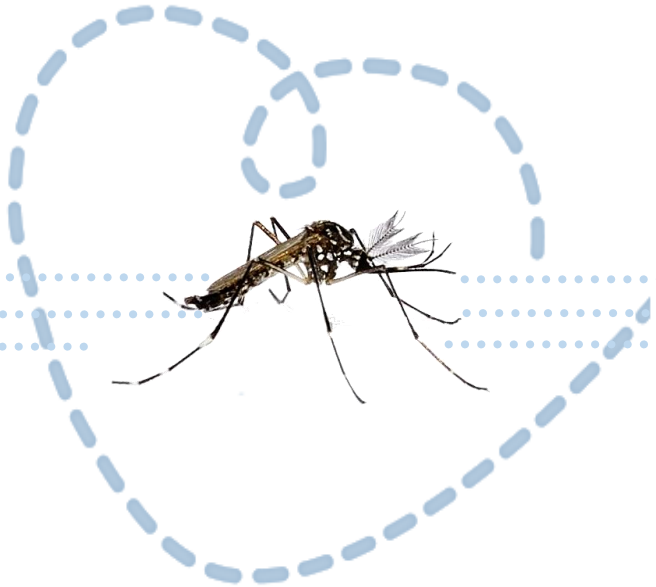
- How Oxitec manages field pilots and data collection
- In-depth review of Oxitec's performance in the past
- *Aedes aegypti* just add water technology optimization in Brazil
- Oxitec and FKMCD proposed pilot project
- Your Questions

Technical Summary - New Generation of Technology

	Technology Characteristics	2nd Generation
1st Generation AND 2nd Generation	Self-limiting: effective control with built-in biosecurity	✓
	No long-term effects; no chemical residues	✓
	Non-toxic, non-allergenic	✓
	No risk of direct or indirect effects on non-target species	✓
Specific to this 2nd Generation technology	**Genetic sex-separation; reduced costs and complexity**	✓
	Advanced fluorescent marker; efficient and effective surveillance	✓
	Multi-generational pest suppression yet without long-term persistence	✓
	Substantive introgression of insecticide susceptibility; synergy with insecticides	✓
	Flexible deployment options (egg, pupae, adult) giving improved accessibility	✓

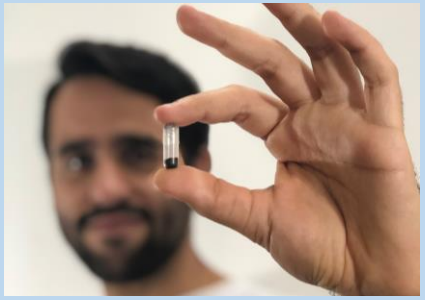
Oxitec's *Aedes aegypti* Mosquito Technology ("OX5034")

OXITEC'S *AEDES AEGYPTI*

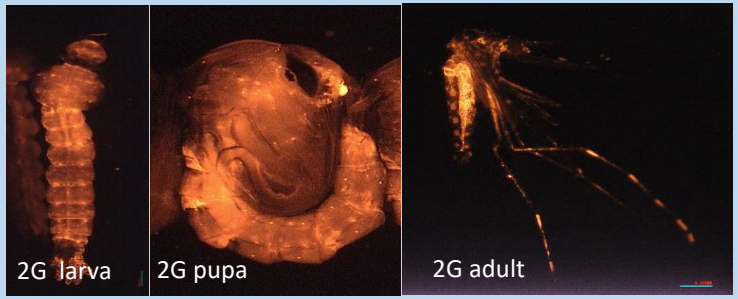


- ✓ TARGETED SUPPRESSION
- ✓ SAFE, NON-TOXIC, NON-ALLERGENIC
- ✓ PROVEN EFFECTIVENESS
- MALE-ONLY RELEASES (male mosquitoes do not bite) ✓
- TRACEABLE IN THE FIELD ✓
- SELF-LIMITING IN THE ENVIRONMENT ✓

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



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



How Oxitec Manages Field Pilots & Data Collection

1

Regulatory Trials

Small | high statistical power | protocol approved by regulators | biology/efficacy measured

2

Demonstration Trials

Larger pilot to demonstrate area-wide performance | study designed w/ regulator | compared with control

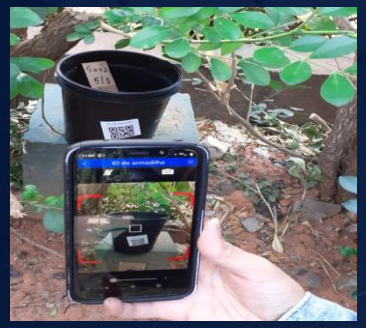
3

Operational Deployment

Deployed as vector control tool to suppress vector population over an area

How We Collect Data

Egg Collection Ovitraps



Small cups
Tracks egg-laying
Ae. aegypti females

Adult Mosquito Collection

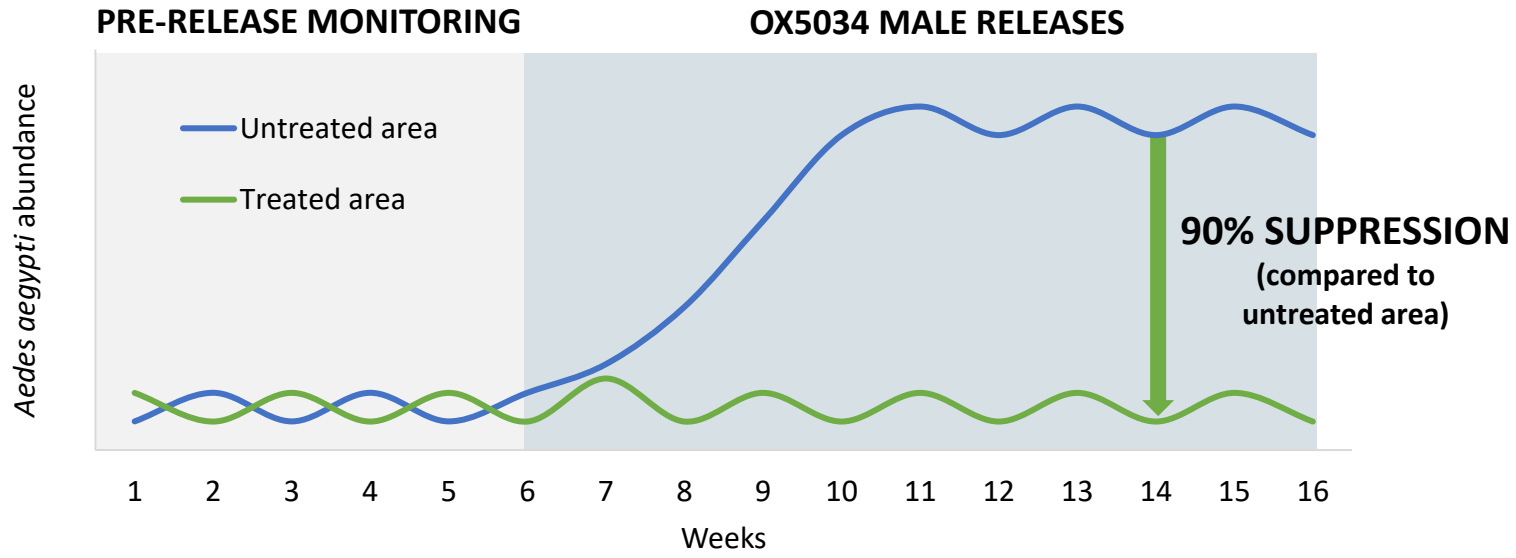
Captures adults
Monitors overflooding
Monitors pop. levels

Lab-based Monitoring/QC

Tracks performance
Confirms quality

How We Measure Performance

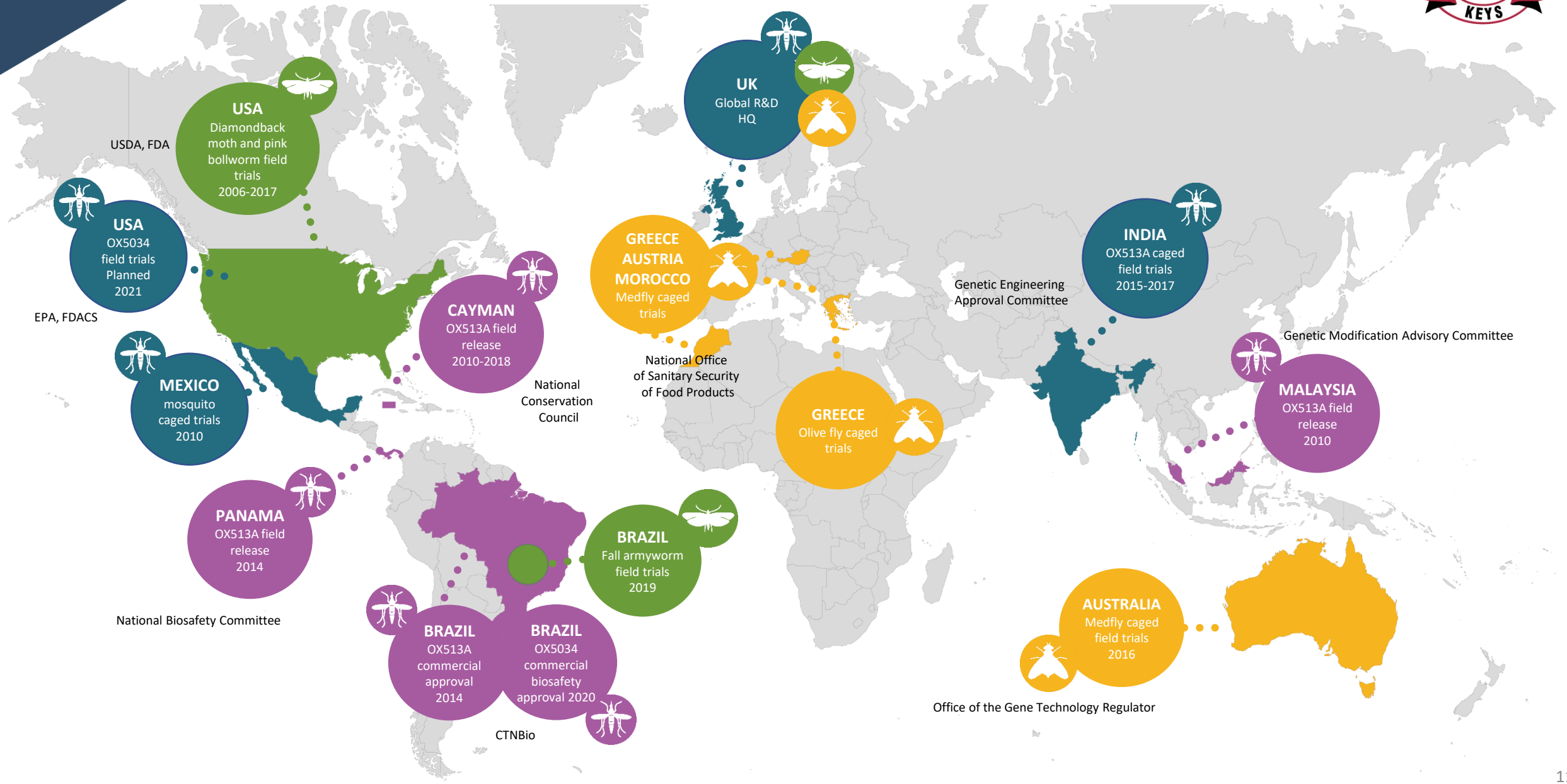
Suppression = change in mosquito population abundance between areas with and without treatment



METRIC	DESCRIPTION	USEFUL FOR
Abundance	The number of wild *Ae. aegypti* in a trap	Checking baseline population levels and changes
Overflooding ratio	The ratio of Oxitec males to wild males	Achieving optimal dose rate
Mating fraction	The proportion of females mated by Oxitec	Evaluating the proportion of the population treated
Efficacy	The percentage of treated females that die	Confirming 100% effective against treated females
Suppression	The percentage reduction in the wild population	Evaluating the net change in the total target population

Field Deployments Overview

10+ Years of Successful Global Regulatory Decisions and Trials



Decade of Pioneering Experience, Lessons & Proof-Points

SELECTED DEPLOYMENT PROGRAMS, 2010 – 2021

***Aedes aegypti* peak suppression measured in each program compared to control sites**

1st GENERATION *AEDES AEGYPTI* DEPLOYMENT PROGRAMS

2nd GENERATION *AEDES AEGYPTI* DEPLOYMENT PROGRAMS

Oxitec in Panama

OX513A Demonstration Trial - Nuevo Chorrillo (2014)

Panama residents named Oxitec male mosquitoes "Mosquitos Amigables"

Purpose: Suppression pilot
Duration: 28 weeks
Partner: Gorgas Institute
Independent Validation: Yes

- **91% & 95% suppression in 1 season**
- **Proven safe & no niche replacement**
- **Two peer-reviewed publications**
- **Strong mating performance**

Oxitec in India

OX513A Regulatory Trials – Dawalwadi (2011 – present)

Population elimination in all field cages after 10-15 weeks of releases

Purpose: Caged Suppression
Duration: 34 weeks
Partner: GBIT
Independent Validation: Yes

Proven *Aedes aegypti* eliminations

Confirmed insecticide susceptibility

Confirmed strong mating capability

Three peer-reviewed publications

Oxitec in Cayman

OX513A Demonstration Trial – East End (2010)

Extremely high pest populations tackled

Published in respected international scientific journal

Photo by RH43 (unmodified)
https://web.archive.org/web/20161021023351/http://www.panoramio.com/photo/65908716

Purpose: Proof of Concept
Duration: 23 weeks
Partner: MRCU
Independent Validation: Yes

World's first GM mosquito performance trial

Proof of concept completed

80-96% Suppression

Oxitec in Cayman

OX513A Demonstration Trial – West Bay (2016)

Mobile laboratory built in the UK, shipped, installed, and employed

Purpose: Area-wide suppression
Duration: 12 months
Partner: MRCU

Novel mobile lab concept tested

62% suppression achieved in one season

Extreme pest levels combatted

Oxitec in Cayman

OX513A Demonstration Trial – West Bay (2018)

Fully adhered to regulatory and operational requirements

"The 2018 collaborative project was a professional scientific endeavor. MRCU's relationship with Oxitec senior scientists and management was positive and supportive. This was a successful collaboration that fully adhered to the mutually agreed upon contract and Operational Plan that was steered through an active Stewardship Committee."

MRCU Director Jim McNelly (July 2020)

Purpose: Area-wide suppression
Duration: 22 weeks
Partner: MRCU

First actively combining OX513A and chemicals

All releases under threshold for females

Lessons learned on Integrated Vector Management

Photo by RH43 (unmodified)
https://web.archive.org/web/20161021023351/http://www.panoramio.com/photo/65908716

Oxitec in Brazil

OX513A Operational Deployment - Piracicaba (2015-2019)

94% of residents wanted extension to other areas
93% of residents wanted the project to continue

Purpose: Operational Vector Control
Duration: 4 years
Partner: Vector Control Unit, Piracicaba
Independent Validation: Yes

98%
peak suppression

83%
or greater year on year

up to
65,000
residents protected

Oxitec in Brazil

OX5034 Regulatory Trial Indaiatuba (2018-2019)

*"The collaboration between the city and Oxitec has been positive and transparent, and **the suppression results in the areas that received Oxitec mosquitoes were excellent.**"*

DR GRAZIELA GARCIA, INDAIATUBA SECRETARY OF HEALTH

Purpose: Regulatory - Replicated Field Trial
Duration: 46 weeks
Partner: Indaiatuba Municipality
Independent Validation: Yes

96%
Suppression

Confirmed biosafety credentials

94%
of residents wanted the project to continue

Oxitec in Brazil

OX5034 Capsule Demonstration Trial Indaiatuba (2019-2020)

Purpose: Replicated Field Trial
Duration: 18 weeks
Partner: Indaiatuba Municipality
Independent Validation:
In Progress

92%
Suppression in just 15 weeks

6
weeks faster than OX513A

Independent Scientific/Peer Review

7
OX513A field studies published

100+
Scientific reports and studies published

Open Access
for everyone

SECTION SUMMARY

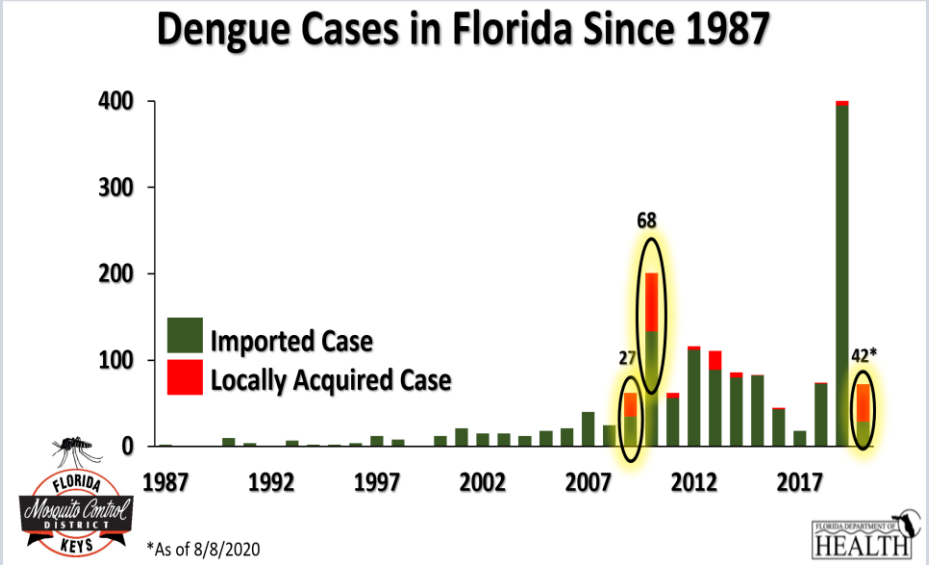
- Performance of Oxitec mosquitoes around the world has been **very strong, outpacing available tools**
- **Novel findings have been published** and are readily available or are in the publication process
- OX513A has **paved the way for a successful OX5034**

STRAIN	COUNTRY	LOCATION	YEAR	INDEPENDENT SCIENTIFIC REVIEW
1st Gen (OX513A)	Grand Cayman	East End	2009	Harris et al (2011) *Nature Biotech*., 29:1034-1037
	Grand Cayman	East End	2010	Harris et al (2012) *Nature Biotech*. 30:828-830
	Malaysia	Pahang	2011	Lacroix et al (2012) *PLoS One*, 7(8): e42771
	Brazil	Itaberaba	2012	Carvalho et al (2015) *PLoS Negl Trop Dis* 9(7): e0003864.
		Mandacaru	2012-2013	Garziera et al (2017) *Entomol. Experiment. Appl.* 164, 327–339 (2017).
		Pedra Branca	2013-2015	
	Panama	Nuevo Chorrillo	2014	Gorman et al (2016) *Pest Man. Sci.* 72(3):618-28. doi: 10.1002/ps.4151.
2nd Gen (OX5034)	Brazil	Indaiatuba – adult release	2018-2019	Publication expected later in 2020
		Indaiatuba – egg release	2019-2020	Project ongoing (post-release monitoring)

Proposed Florida Keys Project

Why now? – Health, Economy, and the Environment

- Dengue is an ongoing issue with 42 confirmed locally-acquired cases so far in 2020 in Monroe County
- The threat of other diseases such as Zika, chikingunya and yellow fever still exists
- Insecticide resistance found in our 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.

FKMCD-Oxitec Proposed Pilot Project

Purpose

1. Broaden the toolbox to protect communities against invasive species and diseases
2. Preserve both the quality of life for residents and the delicate Florida Keys ecosystem
3. Evaluate this safe, innovative tool for fighting *Aedes aegypti*

Project: Evaluate Oxitec's Aedes aegypti Just Add Water Technology

Just add water: Safe, non-biting males are hatched in small boxes using small mini-capsules.

Project Components

1. Community Engagement
2. Mark-Release-Recapture
3. Project A: Single-point Releases
4. Project B: Area-wide Releases

~130
Boxes Placed

~28
Weeks Total

0
Females Released

Pilot Project Design

Project Design Elements

1. Single-point release, trapping males and offspring
2. Multi-point release, trapping offspring
3. Replicated and compared to untreated areas
4. Specific locations to be determined following monitoring
5. Timing: 2021-2022

Evaluation Elements

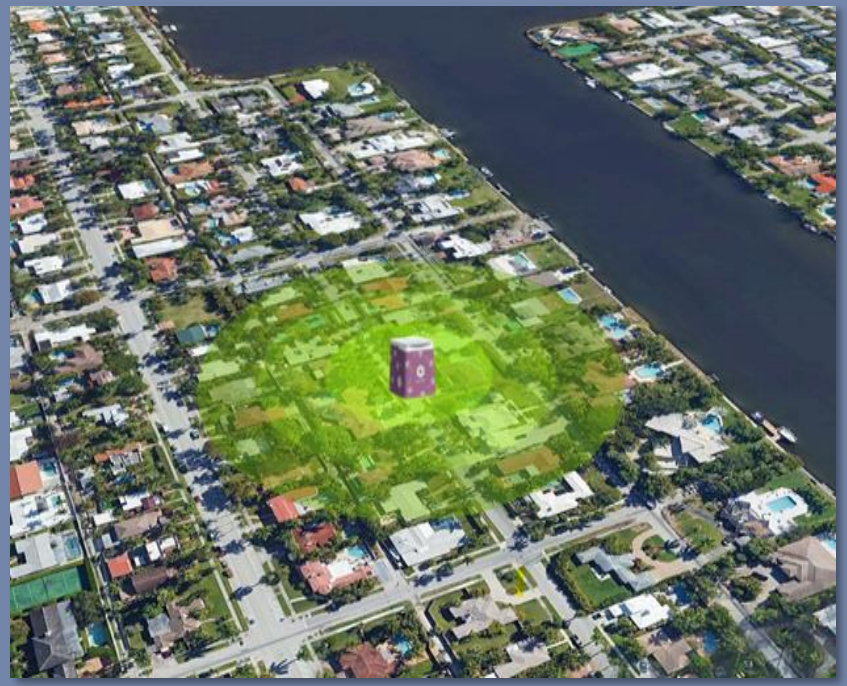
1. Male flight range and longevity
2. Duration of effect (residual activity)
3. Evaluation of natural breeding sites
4. % kill of female mosquitoes
5. % of the wild population treated

Simple devices with capsules of mosquito eggs inside release only male mosquitoes

Trial Locations and Mosquito Releases

PROJECT A

SINGLE POINT RELEASE



1 box placed per week in up to 9 small areas

~12 weeks

LOCATIONS

TO BE SELECTED W/ FKMCD FOLLOWING PEST MONITORING AND INITIAL COMMUNITY ENGAGEMENT

TRAP TO COLLECT MOSQUITO EGGS

TRAP TO COLLECT MOSQUITO ADULTS

PROJECT B

MULTIPLE RELEASE POINTS

Small number of devices placed per week in up to 6 areas

~16 weeks

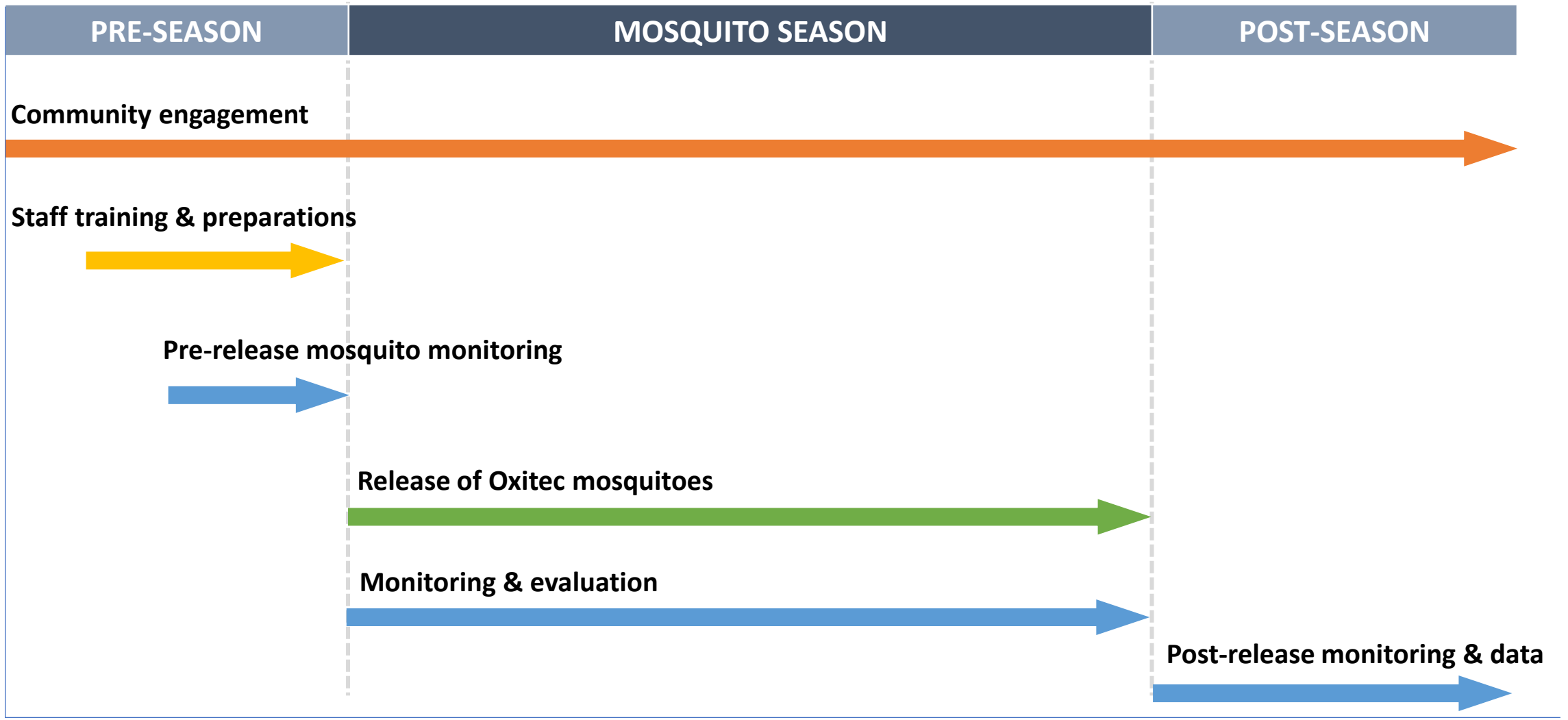
10 Years of Florida Keys Engagement

Working together, FKMCD and Oxitec will continue engaging, listening and sharing with communities in the Florida Keys.

Community Approach:

- Full coordination between FKMCD and Oxitec
- Transparency and robust information sharing
- Listening and learning from communities and stakeholders
- Inclusive engagement programs specific to community members and groups
- Broad view of stakeholders – citizens, communities, businesses, experts
- Multiple avenues for anyone to contact and engage

Florida Keys Pilot Project Timeline - 2021



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)

Conclusion

THANK YOU!

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