Eleutherodactylus coqui Control on O‘ahu: Successful Control of an Incipient Invasive Amphibian

Jane Beachy, O‘ahu Army Natural Resource Program

Rachel Neville and Chelsea Arnott, O‘ahu Invasive Species Committee

Factors Critical to Success

- Small infestation size
- Complete access
- Approved, effective control method
- Adequate funding

COQUÍ BIOLOGY

- Small (30-52mm), Cryptic, Nocturnal
- Feed in leaf litter and canopy
- Territorial
- Diurnal retreats limit population size
- No standing water required
- Peak mating season in warm summer months
- Protected nest sites, male parental care
- 114,000 prey/ night/ hectare
- Predators: snakes, frogs, invertebrates, birds
- "Co-qui" call is 90-100 decibels at 0.5m
- Puerto Rican Density: 20,000 frogs/ha
- Big Island Densities: 28,000 – 89,000 frogs/ha

Dr. Arnold Hara, CTAHR

USDA, APHIS, WS, NWRC, Hilo

Dr. Arnold Hara, CTAHR

IMPACTS ON HAWAI'I




Direct Effects:

- Consumption
- Non-native prey: Ants, Amphipods
- Don't consume termites, mosquitoes
- Native prey: mites, beetles, springtails, flies, snails
- High (native) elevation versus Low (alien) elevation


Secondary Effects:

- Increase nutrient availability, facilitate future invasions


Honolulu Zoo


Dr. Eric VanderWerf

- Competition for prey
- Food source for alien predators


Image Courtesy Jack Jeffrey


HISC

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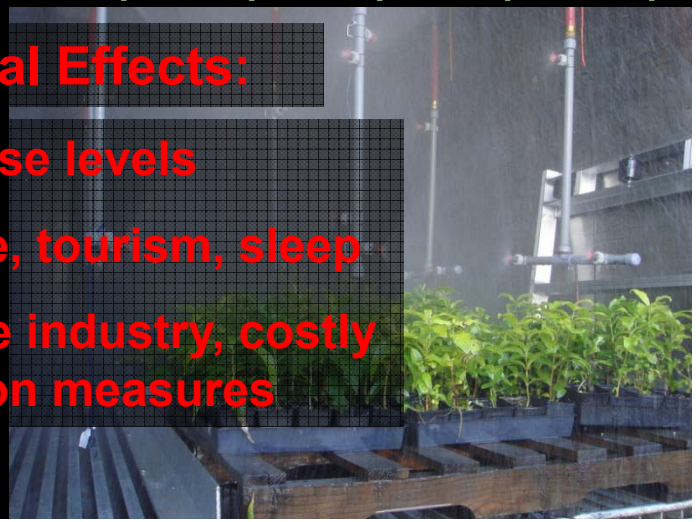
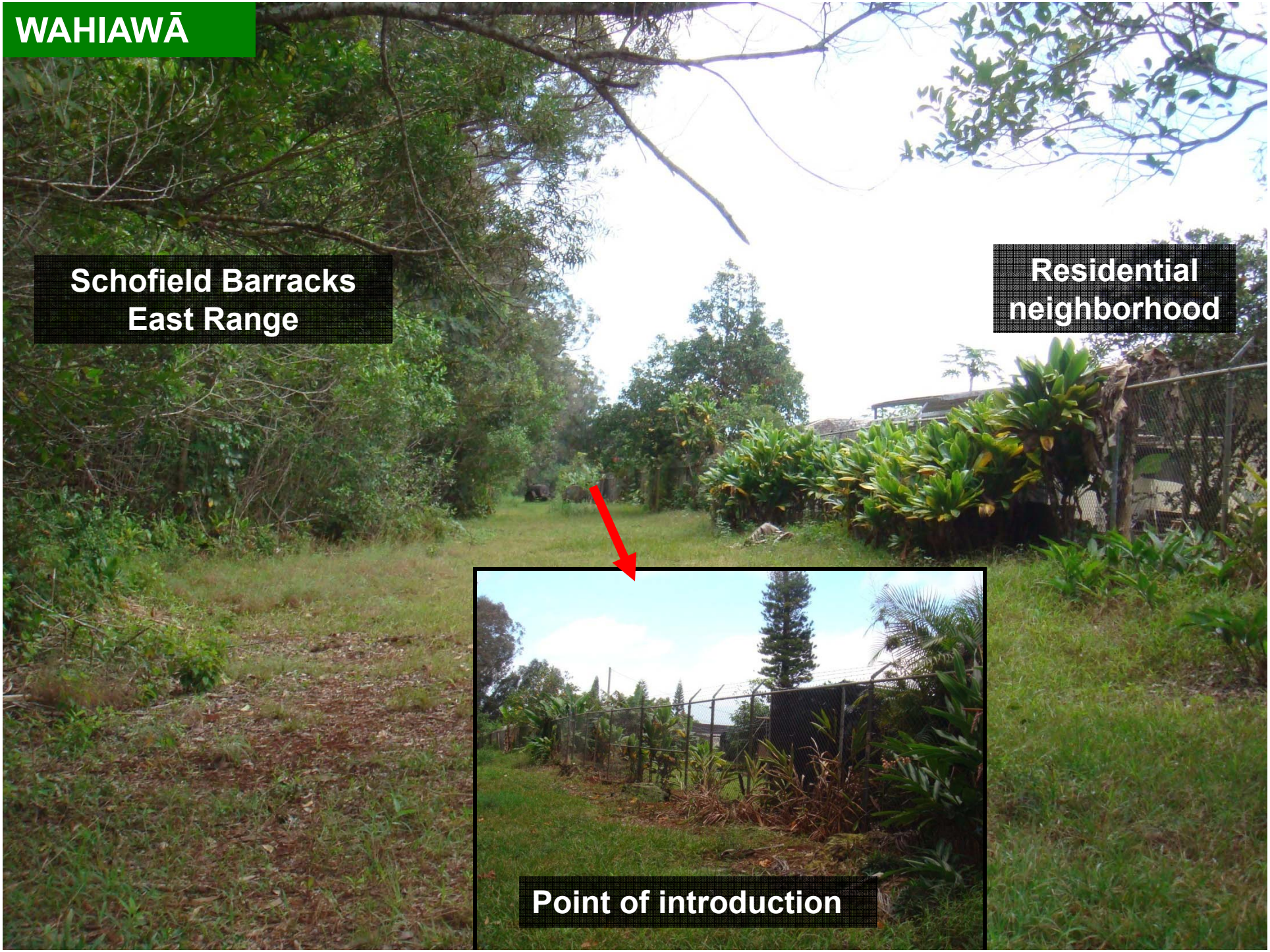
Social Effects:

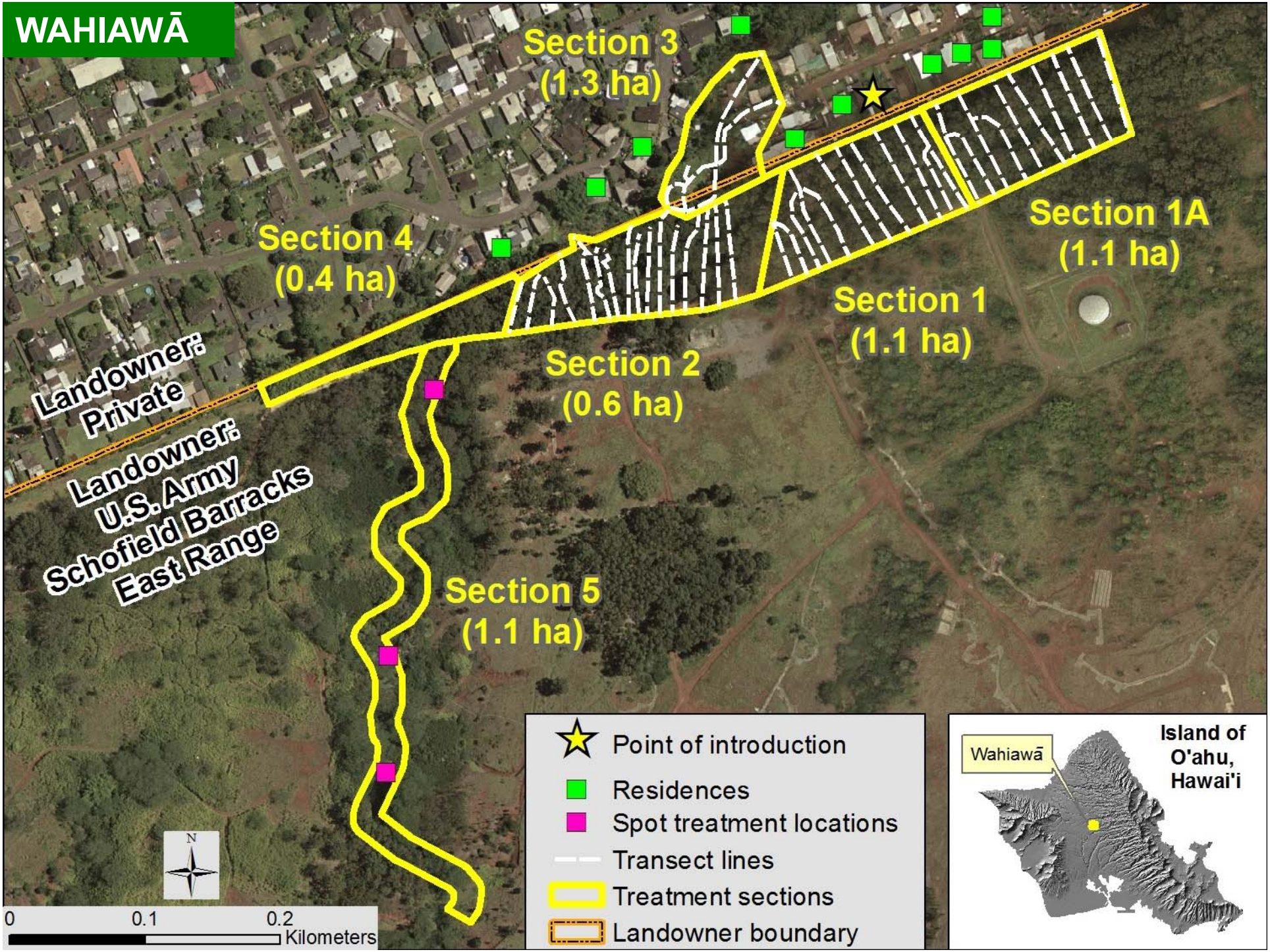
- Noise levels
- Real estate, tourism, sleep
- Horticulture industry, costly sanitation measures



Wahiawā:

- O‘ahu’s only naturalized population of coqui frog.
- Naturalized defined as a large breeding population of frogs in untended vegetation.
- Largest number of frogs on the island
- At its peak in 2004 the population was estimated at 125 calling males (females and non-calling juveniles unable to be counted).


WAHIAWĀ
Schofield Barracks East Range
Residential neighborhood
Point of introduction


WAHIAWĀ
Section 3
(1.3 ha)
Section 4
(0.4 ha)
Section 1A
(1.1 ha)
Section 1
(1.1 ha)
Section 2
(0.6 ha)
Section 5
(1.1 ha)
Landowner:
Private
Landowner:
U.S. Army
Schofield Barracks
East Range
N
0
0.1
0.2
Kilometers
Point of introduction
Residences
Spot treatment locations
Transect lines
Treatment sections
Landowner boundary
Wahiawā
Island of
O'ahu,
Hawai'i

WAHIAWĀ

CONTROL METHODS

Habitat Modification

CONTROL METHODS

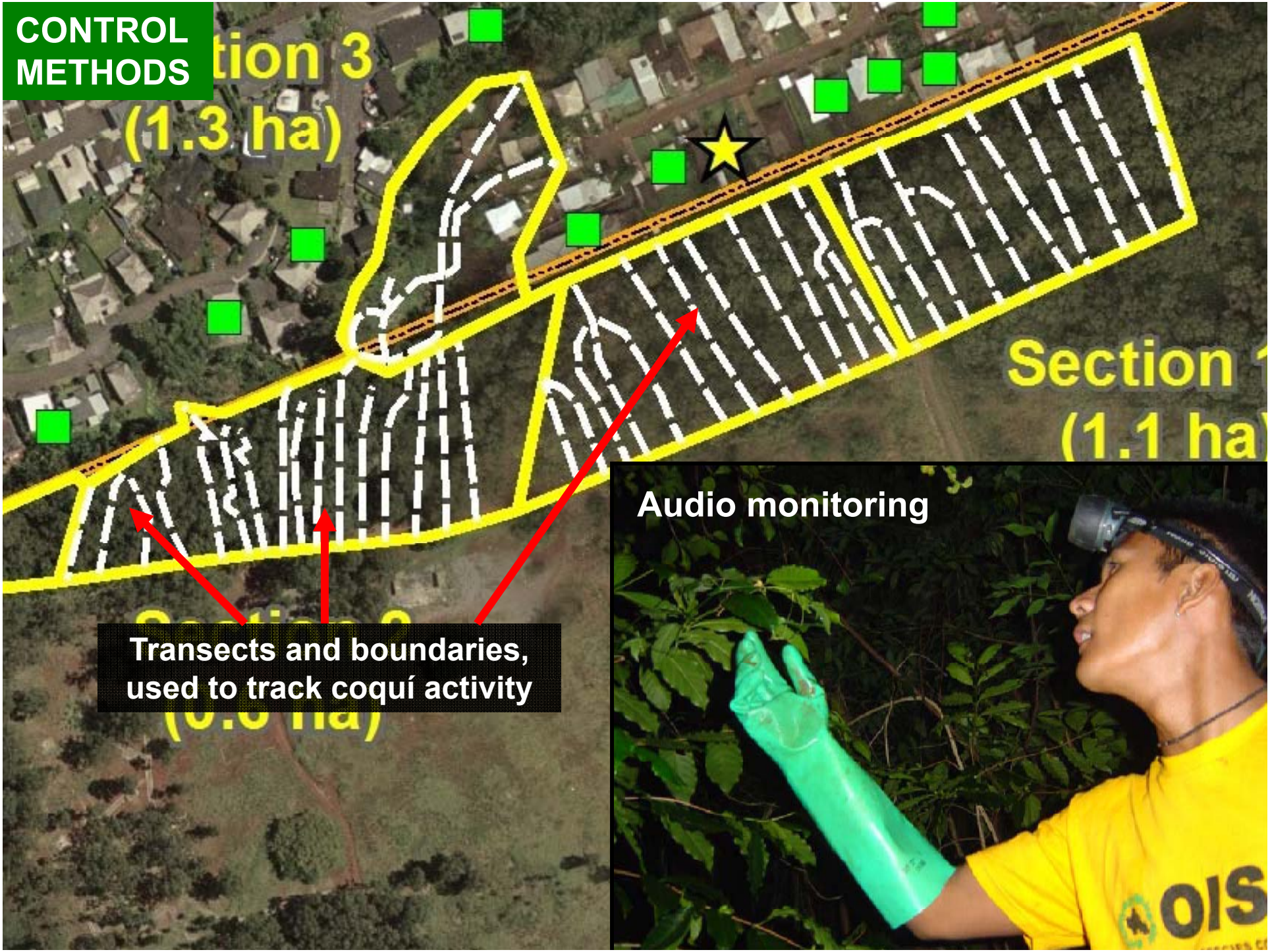
Area drench spray, 16% citric acid, night

Lori Oberhoffer, USDA-APHIS-NWRC Hilo

Hand capture

Area drench spray, 16% citric acid, day

Hot spot spray, 16% citric acid


CONTROL METHODS
tion 3
(1.3 ha)
Section 1
(1.1 ha)
Transects and boundaries, used to track coquí activity
Audio monitoring
OIS

Control Actions

- Habitat modification, Section 1, 2.
- Night sprays begin

- Seasonal spray crew hired.
- Habitat modification, Sections 1A, 2.
- Night sprays continue

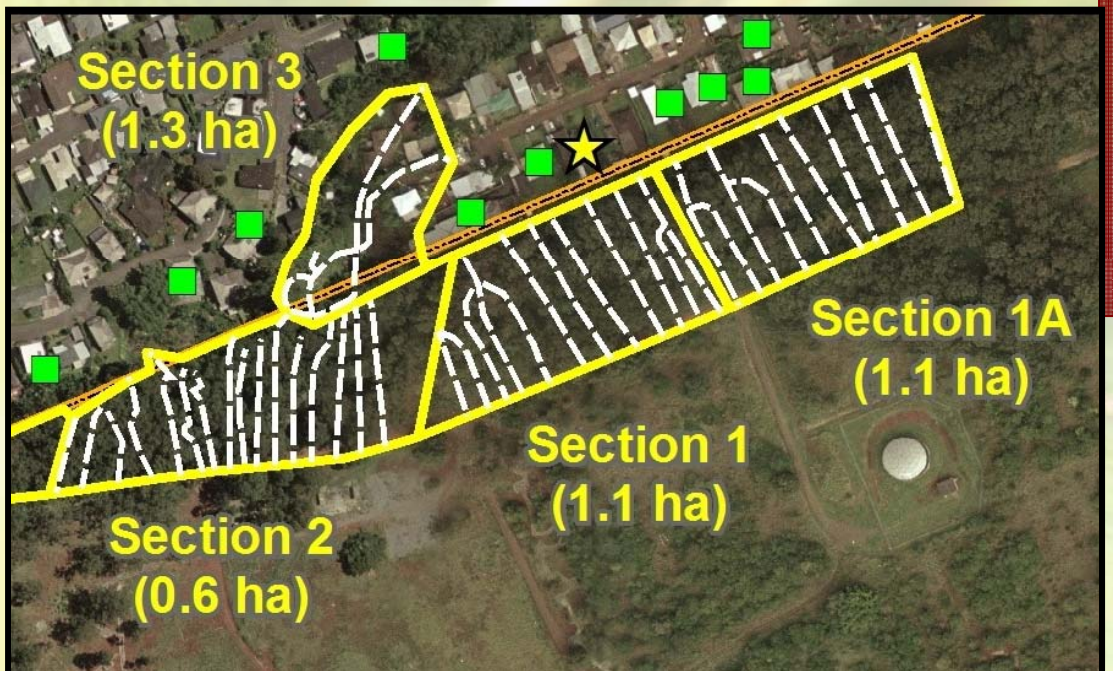
Hand capture

2001 | 2002 | 2003 | 2004

Low estimate, 100+ calling males

1st coquí report

- 125 calling males heard in July.
- Population at peak
- Spread into Section 1A



Coquí Response

Control Actions

2005

- Seasonal spray crew.
- Bulldoze transects in Sections 1, 1A.
- Night sprays continue

- 60+ calling males heard all season.
- Last frogs heard in Sections 1, 1A, 3

2006

- Permanent supervisor hired.
- Seasonal spray crew.
- Habitat modification in Section 4.
- Section 3 bulldozed.
- Sprayer upgrade. Switch to day drenches.

- 29 calling males heard all season.
- Spread into Sections 4, 5.
- Last frogs heard in Sections 2, 4, 5

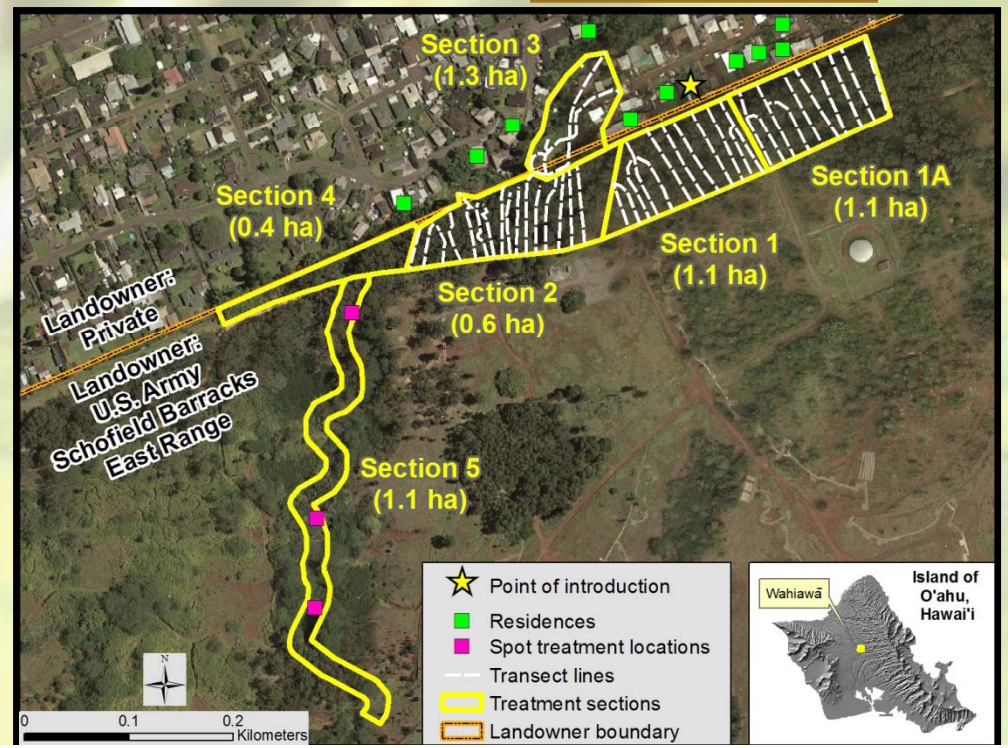
2007

- Seasonal spray crew.
- Day drenches, hot spot sprays

2008

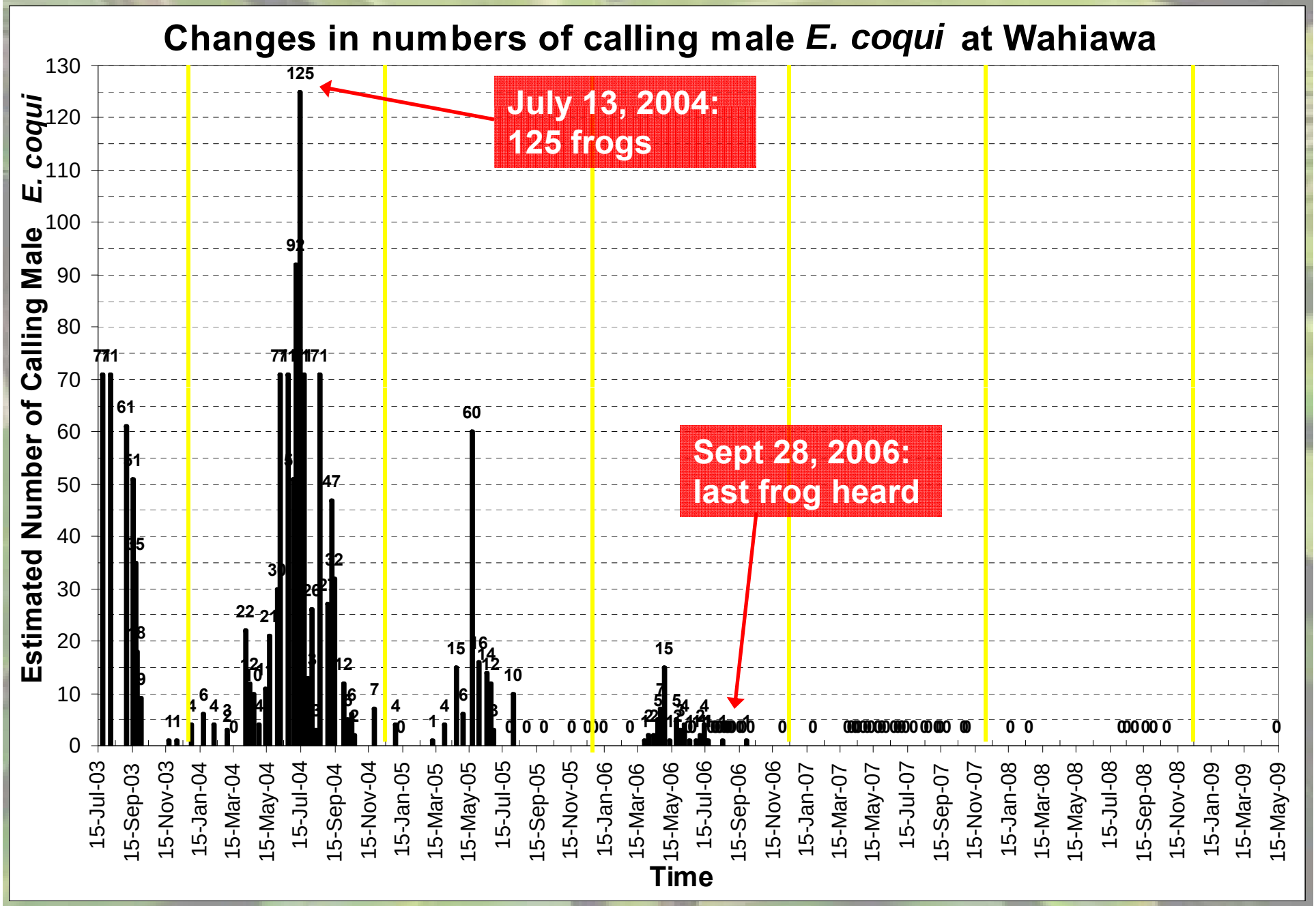
Monitoring only

No frogs heard



Coquí Response

Location	Area (hectares)	Years of Sprays	Volume of Citric Acid (gallons)	Person Hours	Last Frog Heard
Section 1	1.09	5	9,800	528	July 2005
Section 1A	1.13	4	9,500	514	August 2005
Section 2	**0.61**	**5**	**31,590**	**1,972+**	**August 2006**
Section 3	1.25	4	6,700	331.5	July 2005
Section 4	0.45	2	6,551	229	May 2006
Section 5	1.05	2	5,900	237	September 2006
Residences	0.90	5	5,190	376.5	May 2006


Changes in numbers of calling male *E. coqui* at Wahiawa
July 13, 2004:
125 frogs
Sept 28, 2006:
last frog heard
Estimated Number of Calling Male *E. coqui*
Time
0
10
20
30
40
50
60
70
80
90
100
110
120
130
15-Jul-03
15-Sep-03
15-Nov-03
15-Jan-04
15-Mar-04
15-May-04
15-Jul-04
15-Sep-04
15-Nov-04
15-Jan-05
15-Mar-05
15-May-05
15-Jul-05
15-Sep-05
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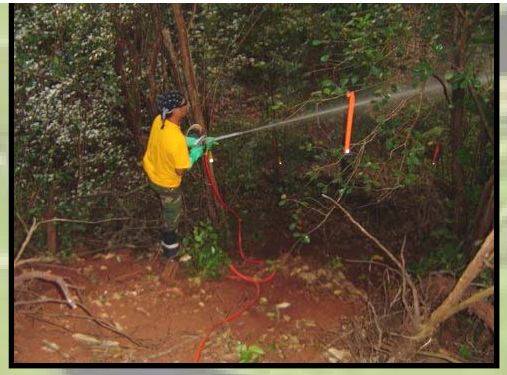
15-Sep-07
15-Nov-07
15-Jan-08
15-Mar-08
15-May-08
15-Jul-08
15-Sep-08
15-Nov-08
15-Jan-09
15-Mar-09
15-May-09

Control Lessons:

- Major habitat modification
- Gentle terrain
- Dedicated spray crew staff
- Large quantities of citric acid
- Aggressive spray schedule
- High volume spray equipment
- Strategic control across entire infestation
- 8 years to eradicate at Wahiawa
- Future eradications may take half that time
- Spread and establishment of coquí not inevitable
- Eradication possible, given adequate resources and staffing



Factors Critical to Success:

SMALL POPULATION SIZE

- 4.45 hectares
- Population peaked at 125 calling frogs; approximately 1,325 total frogs
- Population expansion closely tracked

COMPLETE ACCESS

- Supportive landowners
- Flexible work times

FEDERALLY APPROVED, FEASIBLE CONTROL METHOD

- Citric acid available in 2003
- Multiple groups conducting research and on-the-ground trials

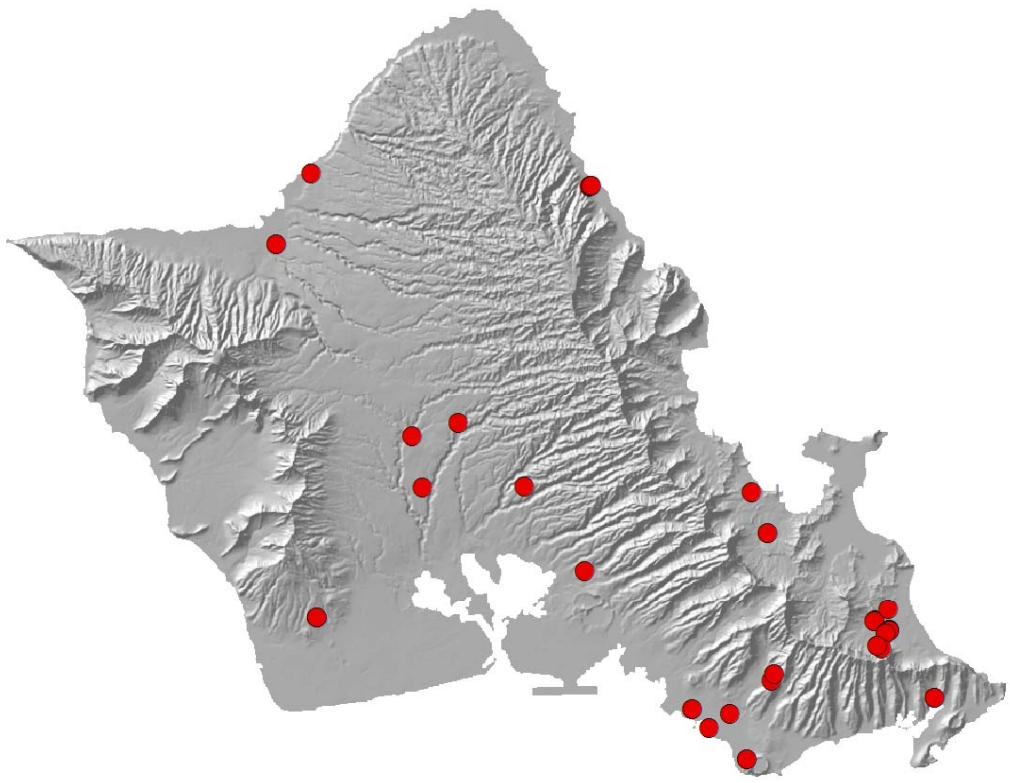
CONSISTENT FUNDING

- $279,113
- Multiple funding sources
- Labor and citric acid

Wahiawā successful but...

…frogs keep coming to O‘ahu

Coqui Frogs collected by OISC January 2008—May 2010



Frogs continue to arrive on O‘ahu because:

- Established on Hawai‘i Island.
- Plants required to be treated with citric acid, but some frogs survive treatment.
- Frogs arrive on non-plants items that are not treated.

Current Control Methods

In cooperation with Hawaii Department of Agriculture:

•Respond to coqui reports from property owners. Hand capture frogs or spray if necessary.

•Monitor nurseries and other hotspots with recording devices.

•Provide assistance (labor and sprayers) to nurseries with coqui frogs. Some nurseries spray their own property.

•Educate the public about what coqui frogs sound like.

How to prevent coqui frogs from naturalizing again?

Drawing: Brooke Mahnken

- Inspections and monitoring must continue.
- Must develop *and deploy* better treatment techniques for plants from Big Island.
- Resources must be available for "coqui house calls" so that frogs can be removed from homes before they move into natural areas.
- Everyone must know the coqui call (available at www.hear.org) and the pest hotline (**643-PEST**) to report coqui!

Mahalo Nui Loa

Seasonal Spray Crew Staff:
Brian Caleda and Dustin Lopiccolo (Crew Leaders), Larry Abbott, Chelsea Arnott, Justin Fujimoto, Susannah Iott, Keoki Kanakaokai, Zachary Luechauer, Christian Sousa, Orion Stanbro, Ryan Tabata, Daniel Tsukayama, Christopher Wittig,

The residents of Wahiawa

Coqui Working Group:

Derek Arakaki, Chelsea Arnott, Becky Azama, Jane Beachy, Brian Caleda, Pat Chee, Domingo Carvalho, Nilton Matayoshi, Keevin Minami, Rachel Neville, Ryan Smith, Mindy Wilkinson, Scott Williamson, Robin Yamamoto

The many individuals and agencies studying and controlling coqui across Hawaii.

The agencies involved with planning and control efforts in Wahiawa

Department of Land and Natural Resources
State of Hawaii

O'ahu Army Natural Resources Program

DPW

OISC
O'AHU INVASIVE SPECIES COMMITTEE

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Malama na Koa

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Pacific Cooperative Studies Unit
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University of Hawai'i at Manoa

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