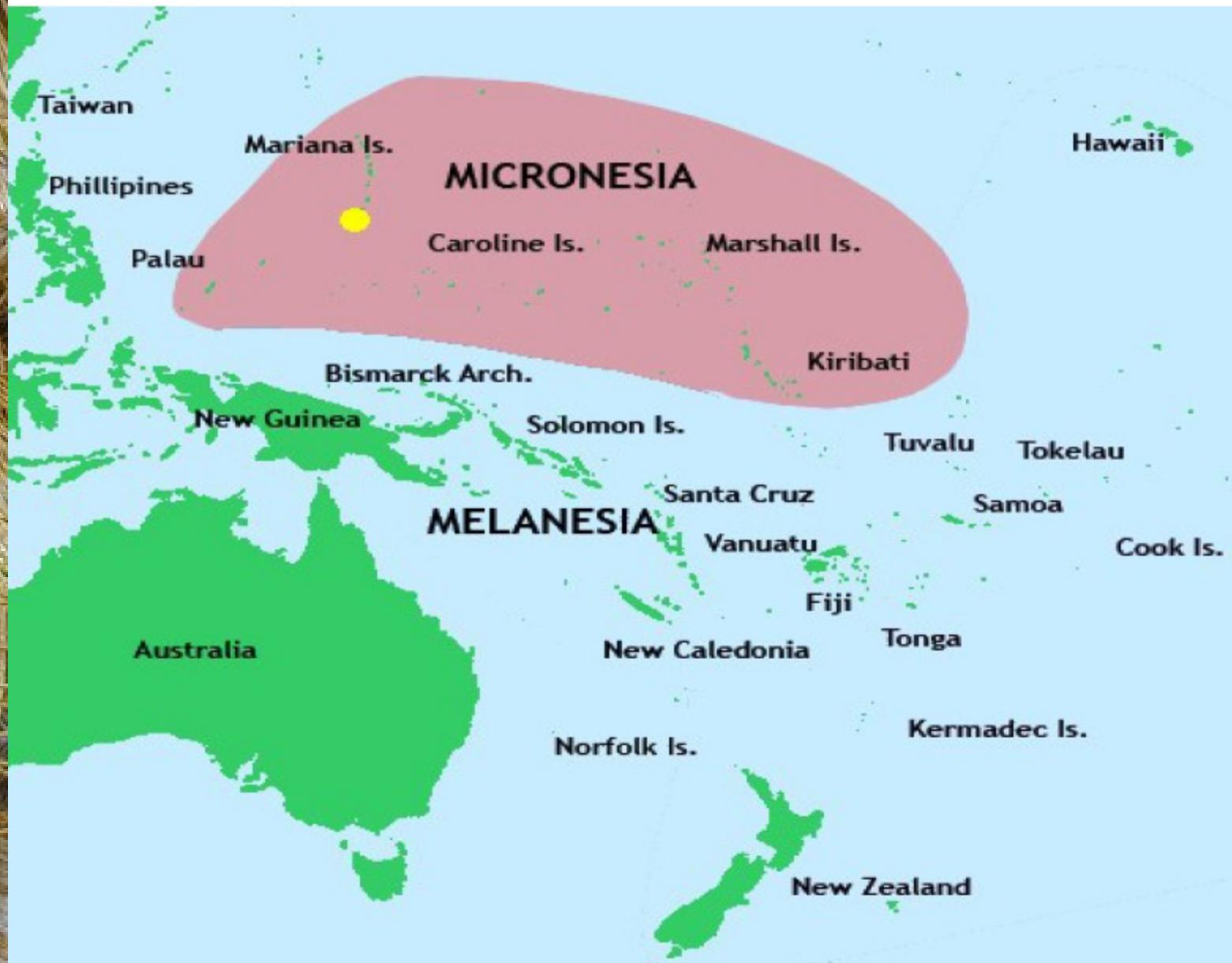


Biological Control of Cycad Scale, *Aulacaspis yasumatsui*, Attacking Guam's Endemic Cycad, *Cycas micronesica*

A close-up photograph of several large, fan-shaped leaves of the Cycas micronesica cycad. The leaves are a vibrant green color with distinct leaflets radiating from a central point. The background is filled with more of these leaves, creating a dense, textured pattern.

Aubrey Moore, Tom Marler, Ross Miller & Lee Yudin
Western Pacific Tropical Research Center
University of Guam

Where is Guam?



Decline of *Cycas micronesica* Following Infestation by *Aulacaspis yasumatsui*

No reproduction since 2005
Only 7% of plants have survived
(January 2013)

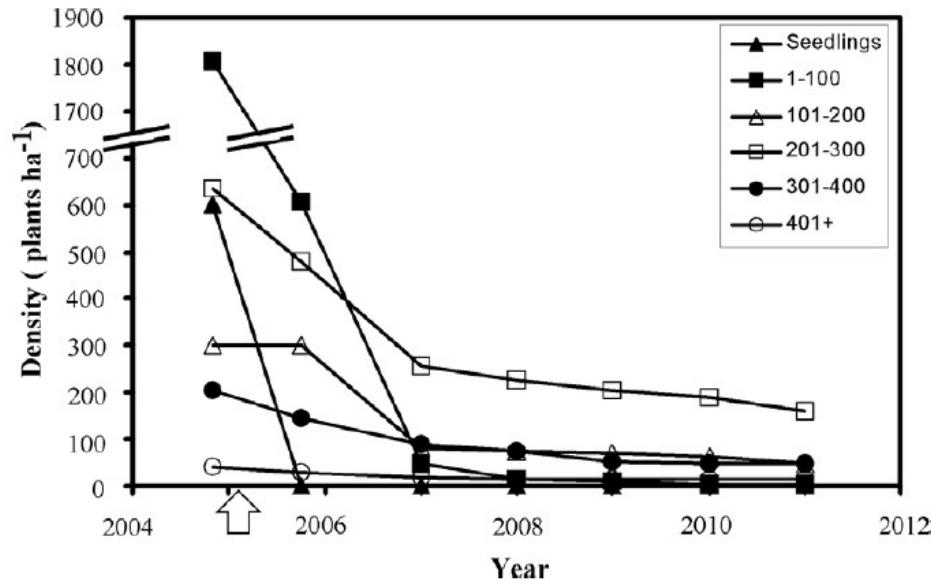
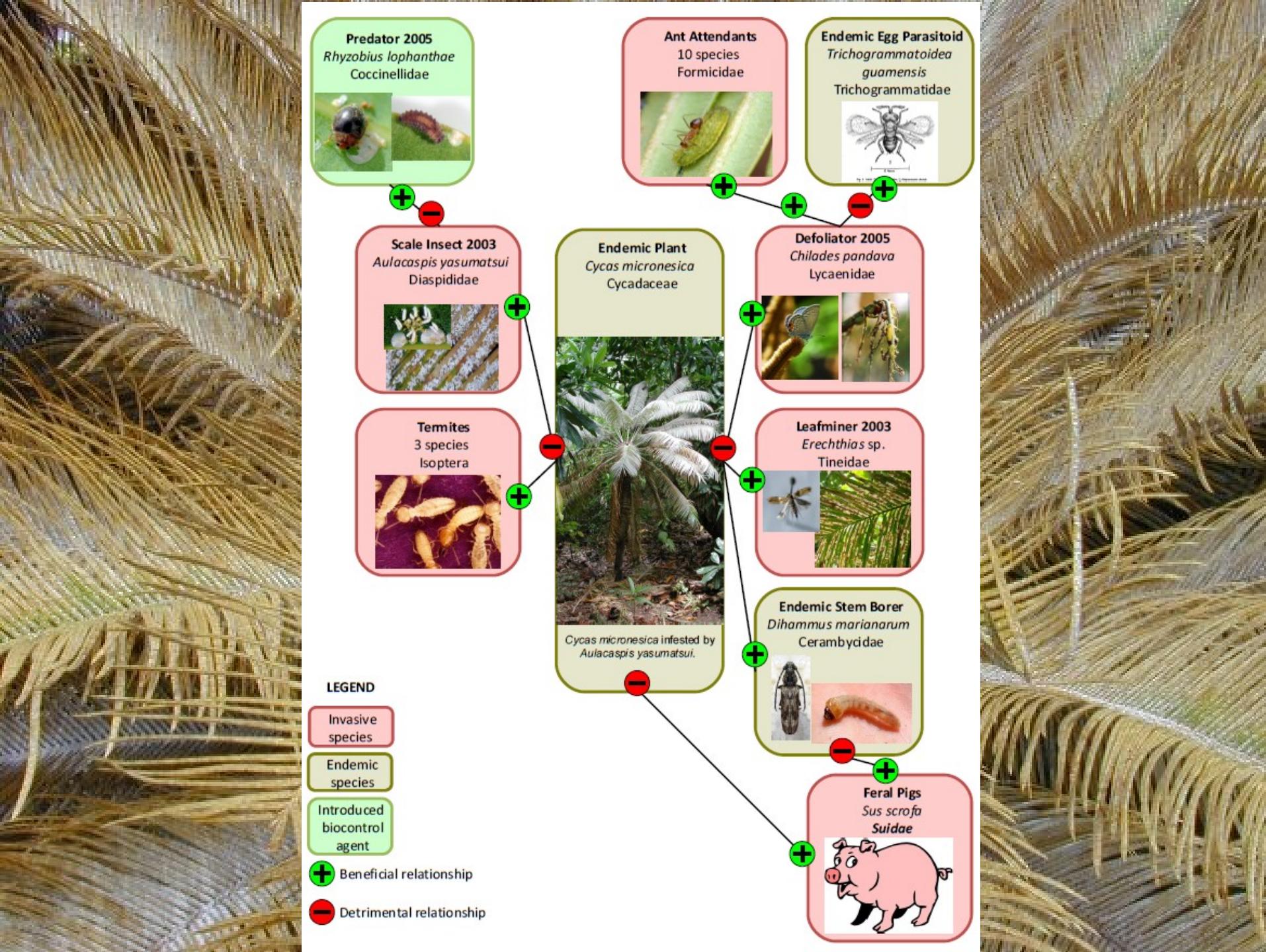


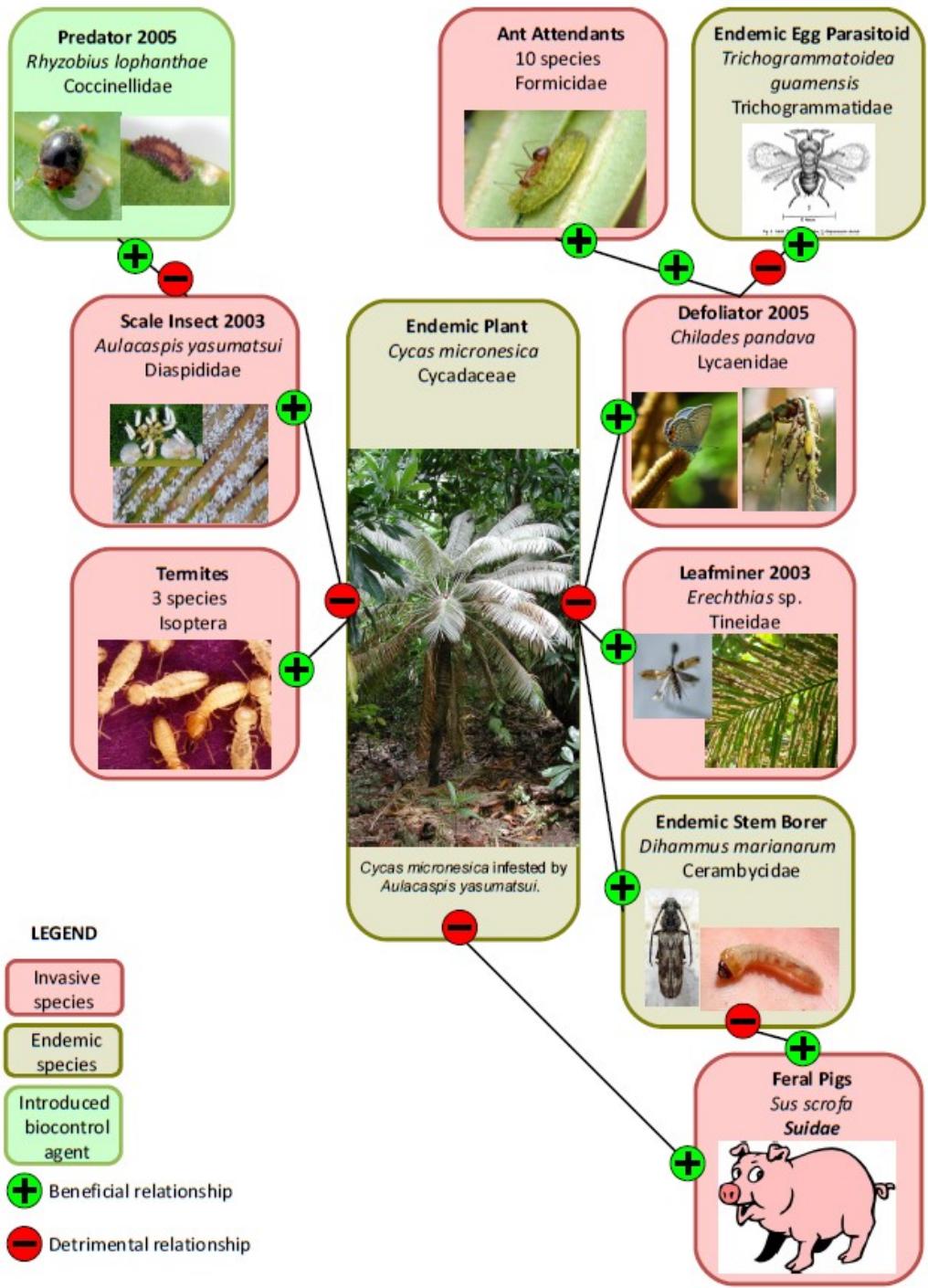
Figure 2. The influence of plant height size categories (cm) on survival of *Cycas micronesica* following the establishment of *Aulacaspis yasumatsui* in western Guam. The x-axis refers to January of each calendar year. Arrow on x-axis marks the initial infestation of *A. yasumatsui* in the study habitat.

Source: Marler, T.E. and J.H. Lawrence 2012. Demography of *Cycas micronesica* on Guam following introduction of the armoured scale *Aulacaspis yasumatsui*. *Journal of Tropical Ecology*, 28:233-242.









Recent New Island Records for Cycad Associates on Guam

2013-01-25 DIASPIDIDAE

Lingaspis rossi* infesting *Cycas micronesica

2013-01-25 APHELINIDAE

Aphyitis* sp.? parasitizing *Lingaspis rossi

2013-01-25 DIASPIDIDAE

Pseudaonidia* sp. infesting *Cycas revoluta

2013-02-10 ENCYRTIDAE

Arrhenophagus?* sp. parasitizing male *Aulacaspis yasumatsui* infesting *Cycas micronesica

2013-01-25 DIASPIDIDAE
Lingaspis rossi infesting
Cycas micronesica

2013-01-25 APHELINIDAE
Aphytis? sp. parasitizing
Lingaspis rossi



2013-01-25 DIASPIDIDAE
Pseudaonidia sp. infesting
Cycas revoluta



2013-02-10

ENCYRTIDAE

Arrhenophagus? sp.

parasitizing male

Aulacaspis ysumatsui

infesting *Cycas*

micronesica



A close-up photograph of a cycad leaf, showing its characteristic pinnate venation. The leaf is a vibrant green color, with many fine, parallel veins radiating from a central midrib. The overall texture appears slightly rough or scaley, which serves as the background for the title text.

Asian Cycad Scale

Aulacaspis yasumatsui Tagaki 1972

DIASPIDIDAE

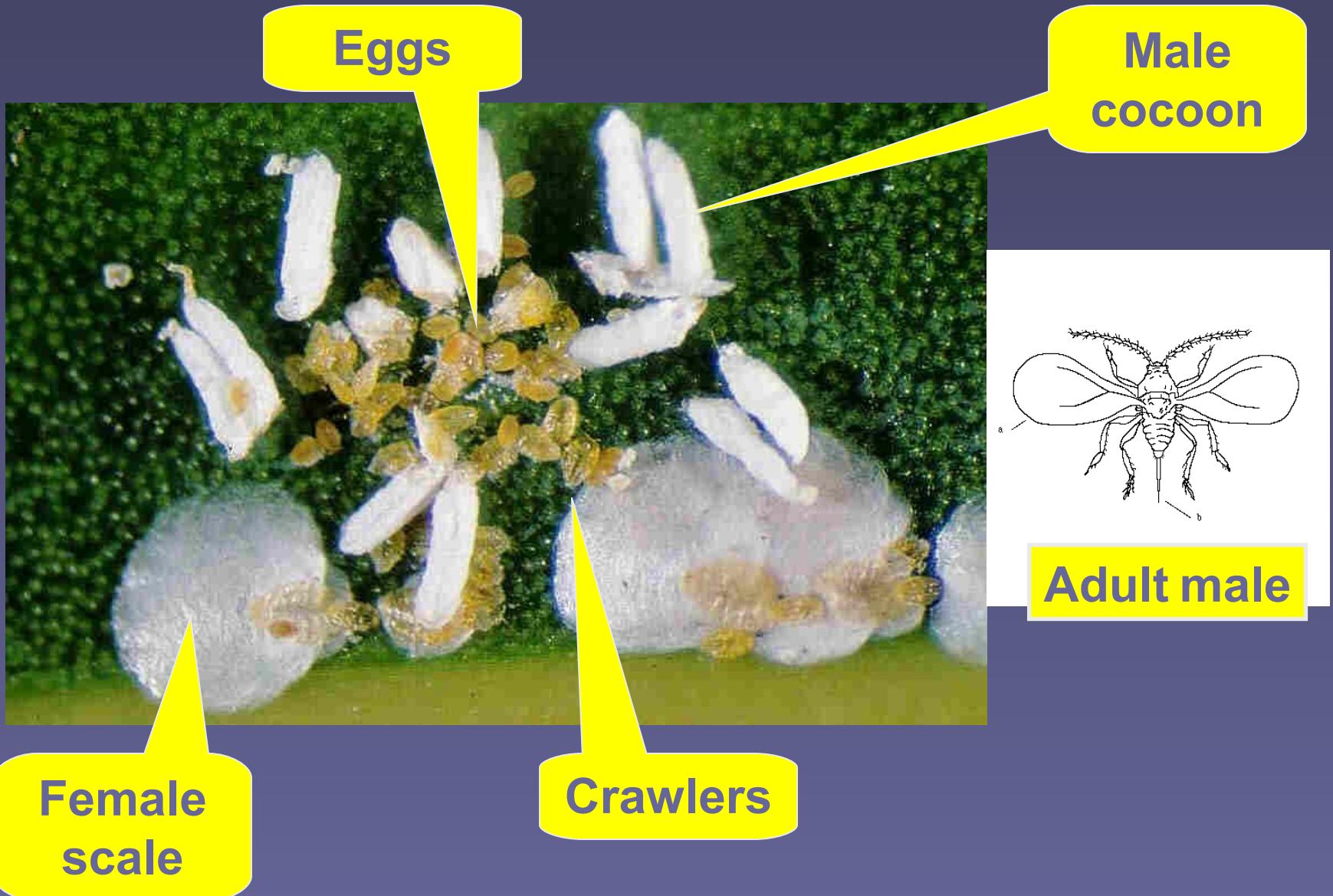
Asian Cycad Scale Chronology

- 1996 – Scale detected in Florida on cycads growing in a botanical garden
- 1998 – Scale detected in Hawaii
- 2003 – Scale detected on cycads used for landscaping in Tumon hotel district on Guam
- 2004 – Scale spreads to *Cycas revoluta* and *C. micronesica* throughout of Guam
- 2006 – Scale infests *C. micronesica* on Rota





Scale Morphology & Life History





























29 DEC 2004





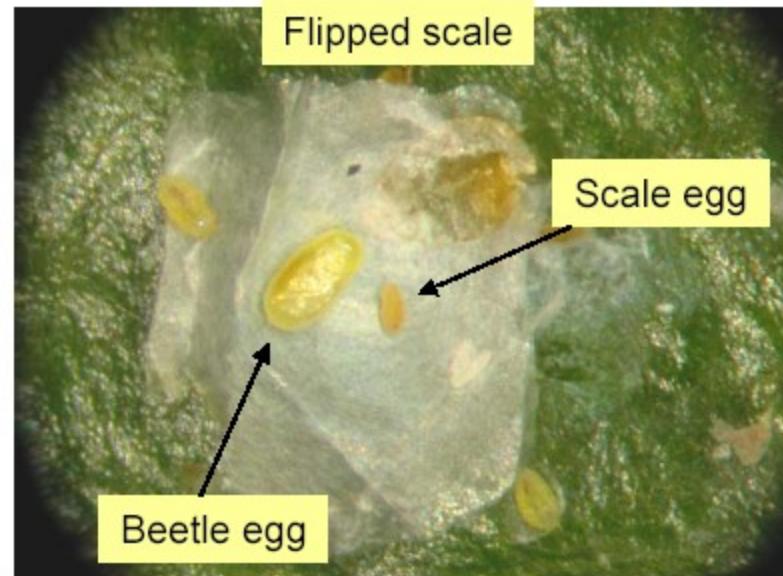
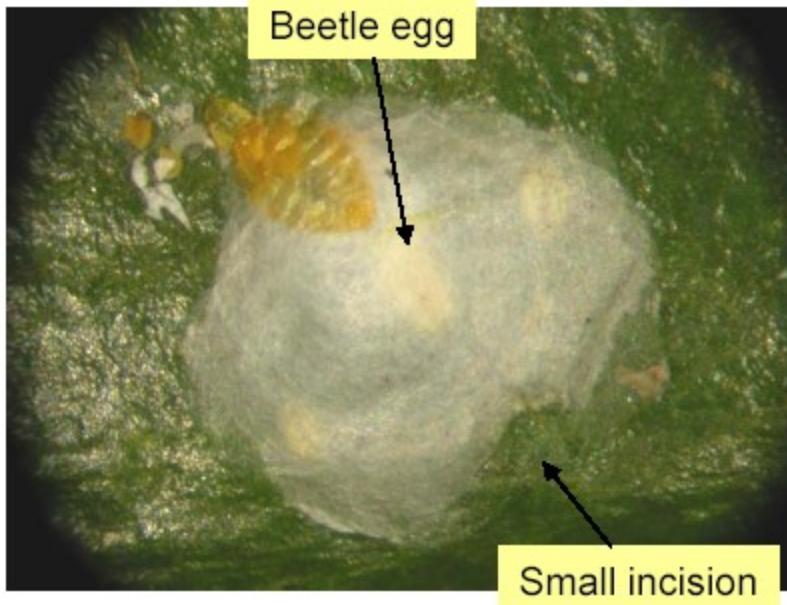
Rhyzobius
lophanthae
Biology

Rhyzobius lophanthae
COCCINELLIDAE
Purple scale destroyer

- Both adults and larvae feed on Diaspidids, armored scales
- Introduced from Australia to California in 1892; from California to Hawaii in 1894
- Released on Guam in 1925 & 1926, but was never recovered



Top view of the Asian Cycad scales



Photos courtesy of Stacey Chun, University of Hawaii, Hilo







Importation /
Propogation /
Field Releases

Rhyzobius lophantheae

Chronology

- 10 June 04 – Import permits requested
 - 17 Aug 04 – Permits approved
- 12 Nov 04 – ~100 adults collected on Maui were hand-carried to Guam; quarantined for 1 month
- 16 Feb 2005 – First field releases at Ritidian Pt.
- 20 May 2005 – First adults recovered
- 7 July 2005 – High density of beetles observed within 1 km radius of release sites
- 12 Aug 2005 – Live scales very hard to find at Ritidian Pt.





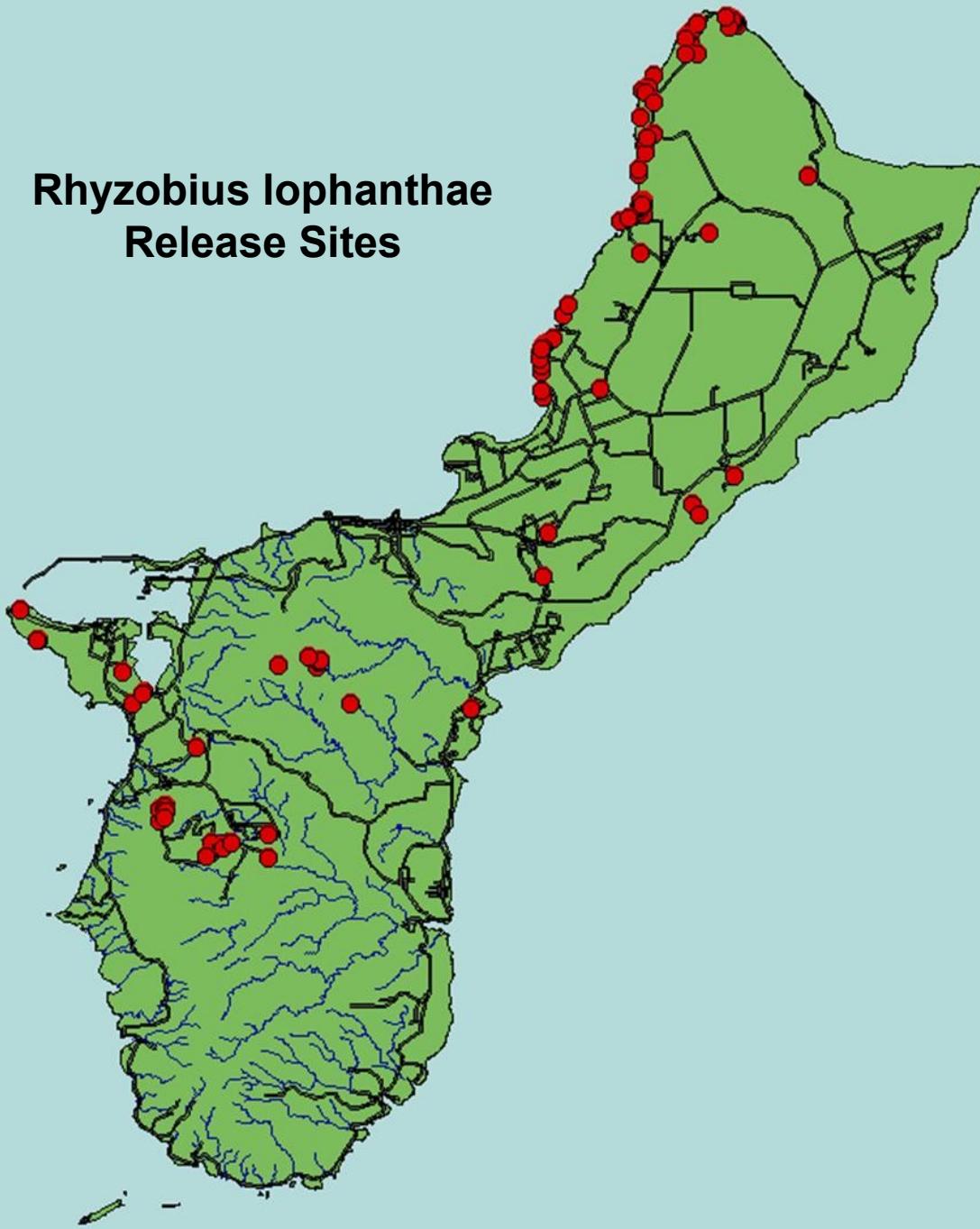








Rhyzobius lophanthae
Release Sites



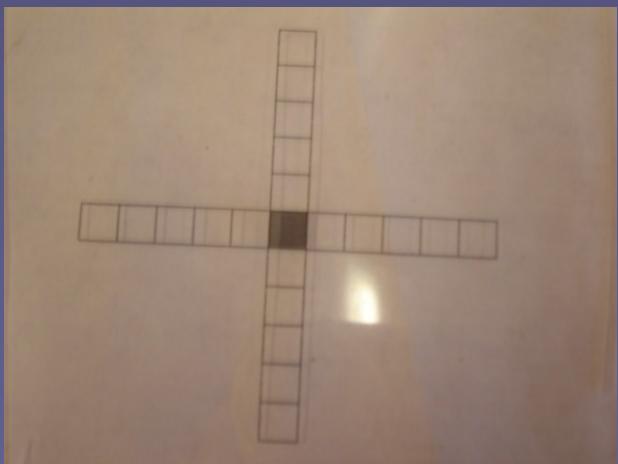
Beetle Collections and Releases



Monitoring



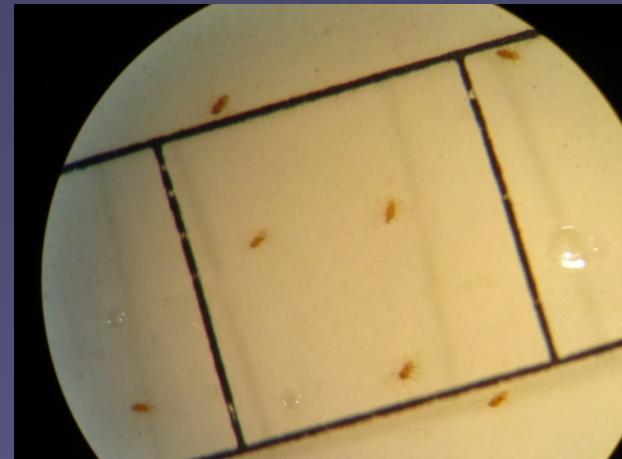
Sticky Traps



Stereoscope



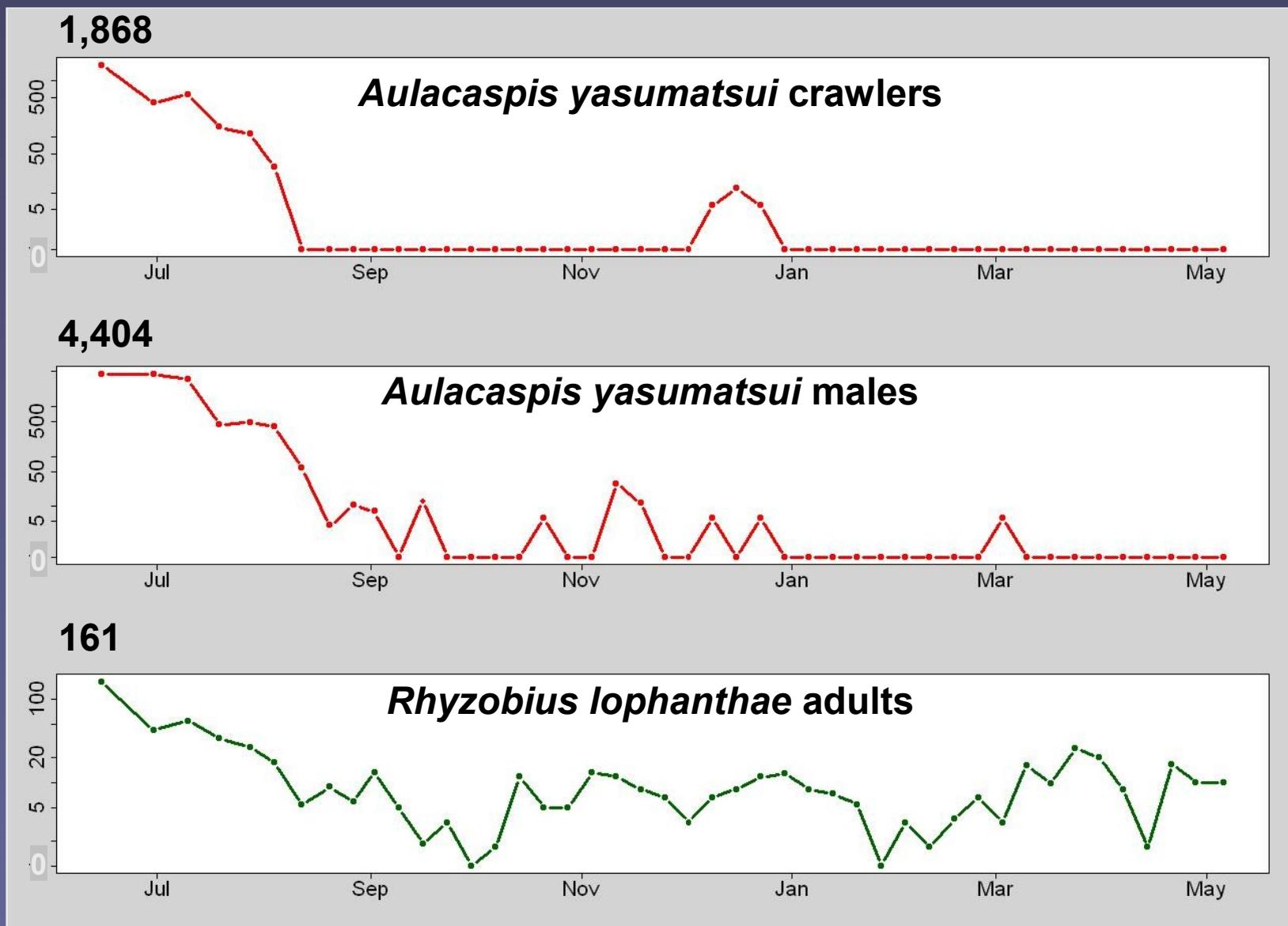
Aulacaspis yasumatsui
Adult males & Crawlers



Rhyzobius lopanthae
Adults

Insects per m² per day on Sticky Traps

Ritidian Pt.; June 2005 - May 2006



One Minute Beetle Counts

One minute adult *Rhyzobius lophantheae* counts Ritidian Pt.; September 2006

- Plants examined: 86
- Plants with adult beetles: 54 (63%)
- Plants without adult beetles: 32 (37%)
- Mean number of adult beetles counted on each plant: 4.1

Leaf Samples

Leaf Sample Analysis

Ritidian Pt.; January 2007

	Untreated	Treated	P (Fisher's exact test)
Leaf Samples	105	69	
Samples with scale predation by beetles	99 94%	33 48%	0.000 ***
Samples with live beetle larvae	17 16%	5 7%	0.545 ns

Conclusions

Current Conditions on Guam

- *Rhyzobius lophantheae* has established throughout the island and is helping to control the Asian cycad scale infestation on wild and ornamental cycads



29 DEC 2004



14 OCT 2007



However

- Most ornamental cycads have been killed and between one-third and two-thirds of the endemic *Cycas micronesica* have died from attacks by ACS and other recently arrived invasive insects.
- *C. micronesica*, which was Guam's most populous tree in 2002, is now on the IUCN Red List of Threatened Species.

Acknowledgments

- Hawaii DOA
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- Jesse Bamba
- Rudy Estoy

