Status of the Breeding Nile Monitor Population in Palm Beach County, FL

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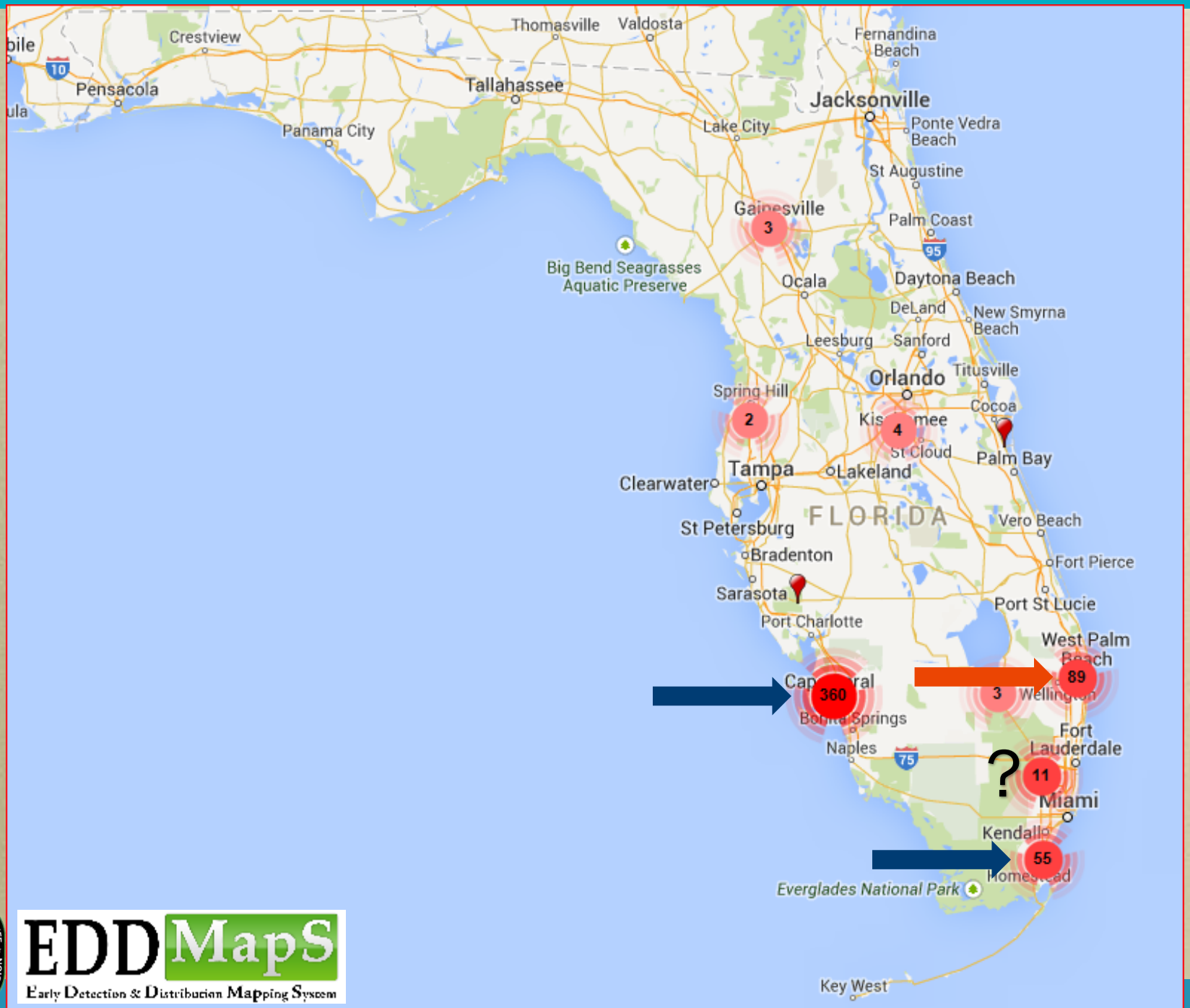
Nile monitor (*Varanus niloticus*)

- Native to Sub-Saharan Africa
- Habitat and diet generalists
- Terrestrial but often associated with water
- Grow 5-6 feet in length
- Light yellow to olive with bands of ocelli

Nile Monitors in Florida

- Small population near Homestead Speedway for 20+ years
- Large population in Cape Coral since 1990s
- Single reports in SW Ranches and Hollywood areas of Broward
- Population along C-51 canal in West Palm Beach (Southern Blvd) discovered in 2010
- Conditional Species

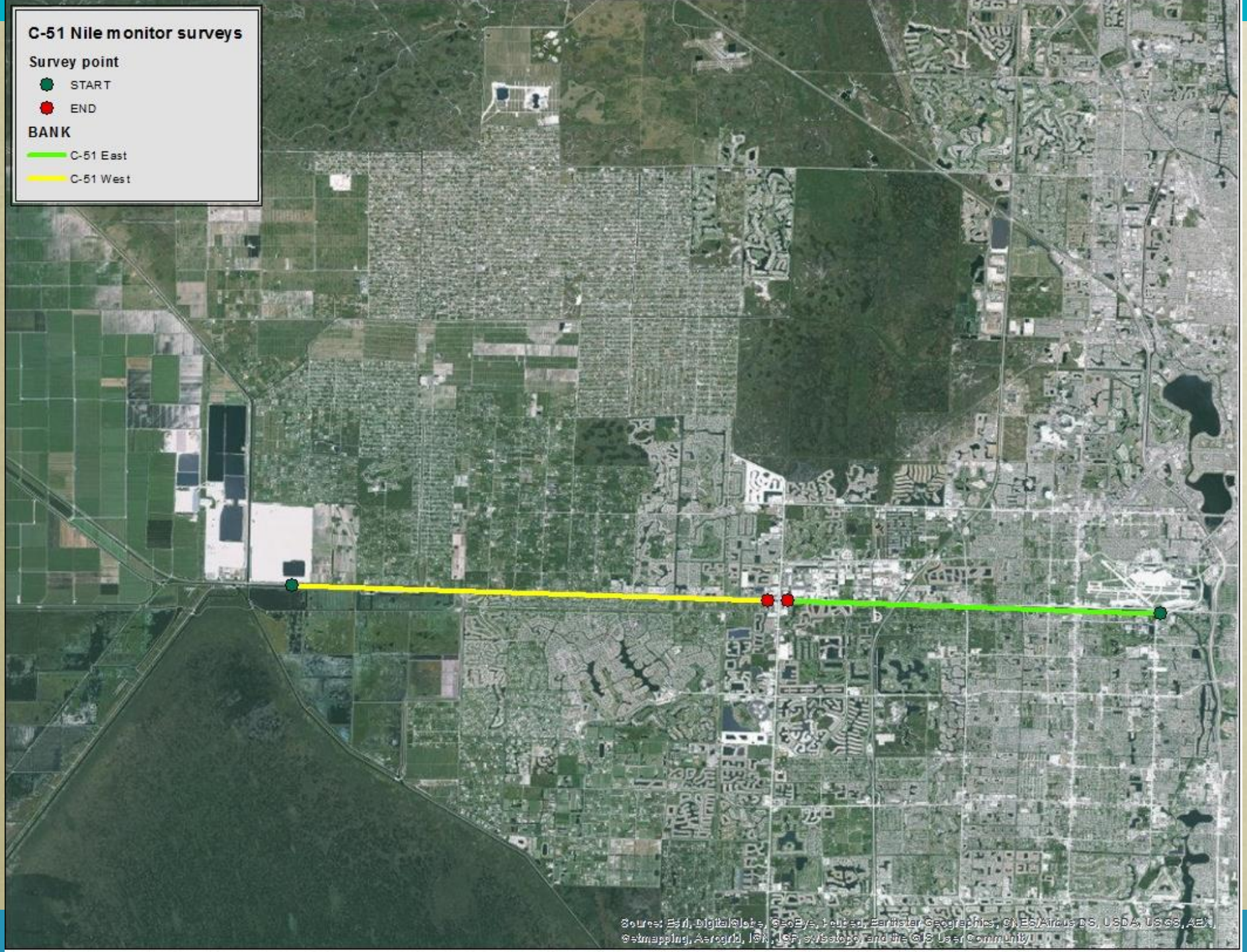

Crestview
Pensacola
Thomasville
Valdosta
Tallahassee
Panama City
Fernandina Beach
Jacksonville
Lake City
Ponte Vedra Beach
St Augustine
Gainesville
3
Palm Coast
95
Big Bend Seagrasses Aquatic Preserve
Ocala
Daytona Beach
DeLand
New Smyrna Beach
Leesburg
Sanford
Titusville
Orlando
Spring Hill
2
Cocoa
4
Palm Bay
Tampa
Lakeland
Clearwater
FLORIDA
St Petersburg
Vero Beach
Bradenton
Fort Pierce
Sarasota
Port St Lucie
Port Charlotte
West Palm Beach
89
360
3
Naples
Fort Lauderdale
75
?
11
Miami
Kendall
55
Everglades National Park
Key West
EDDMapS
Early Detection & Distribution Mapping System

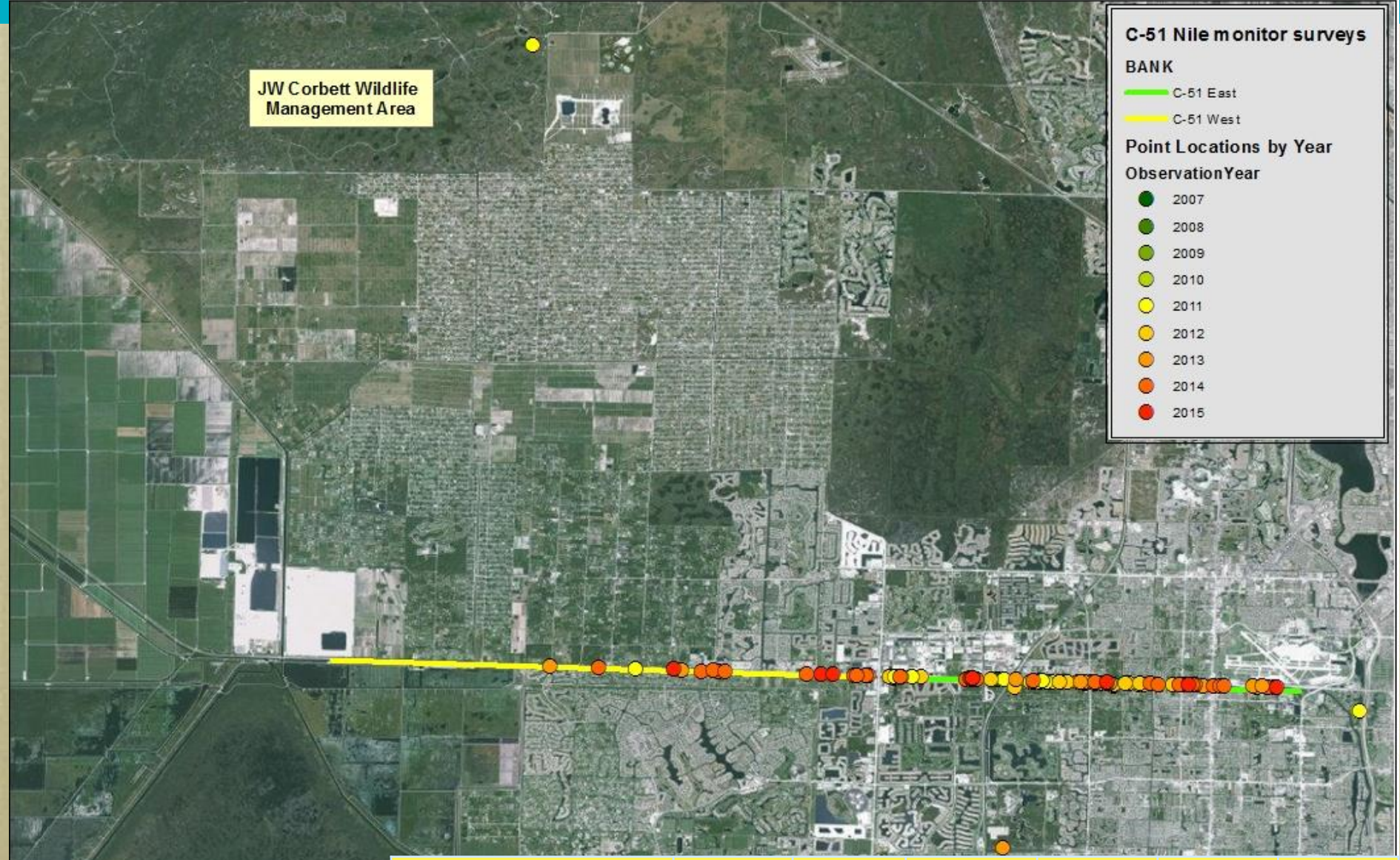
C-51 Nile monitors

- Breeding population along large canal in suburban Palm Beach County
- Sightings from 2007
- Copulating pair spotted in June, 2011
- Hatchlings reported in January and February, 2012

Management actions

- Surveys with firearms from 2011—2015 by FWC, UF, & SFWMD
- Two transects (C-51 East & C-51 West)
- Focused on east side
- Started monthly on C-51 East
- Increased surveys to 4-6/month, both sides
- Conduct necropsies (reproductive status, diet, overall health)
- Plot locations


C-51 Nile monitor surveys
Survey point
START
END
BANK
C-51 East
C-51 West
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Year (# surveys)	2011 (6)	2012 (12)	2013 (16)	2014 (43)	2015 (18)	Total
Observed	12	14	10	31	7	**74**
Removed	2	9	7	19	5	**42**

How to assess our efforts?

- Goal is to assess populations and effectiveness of efforts
- Often an issue in invasive species management
- Detectability, spatial distribution, and relative abundance
  - Hampered by low number of surveys, observations, and removal
- Ways to improve detectability
  - Temporal and environmental conditions

Methods – Site Occupancy

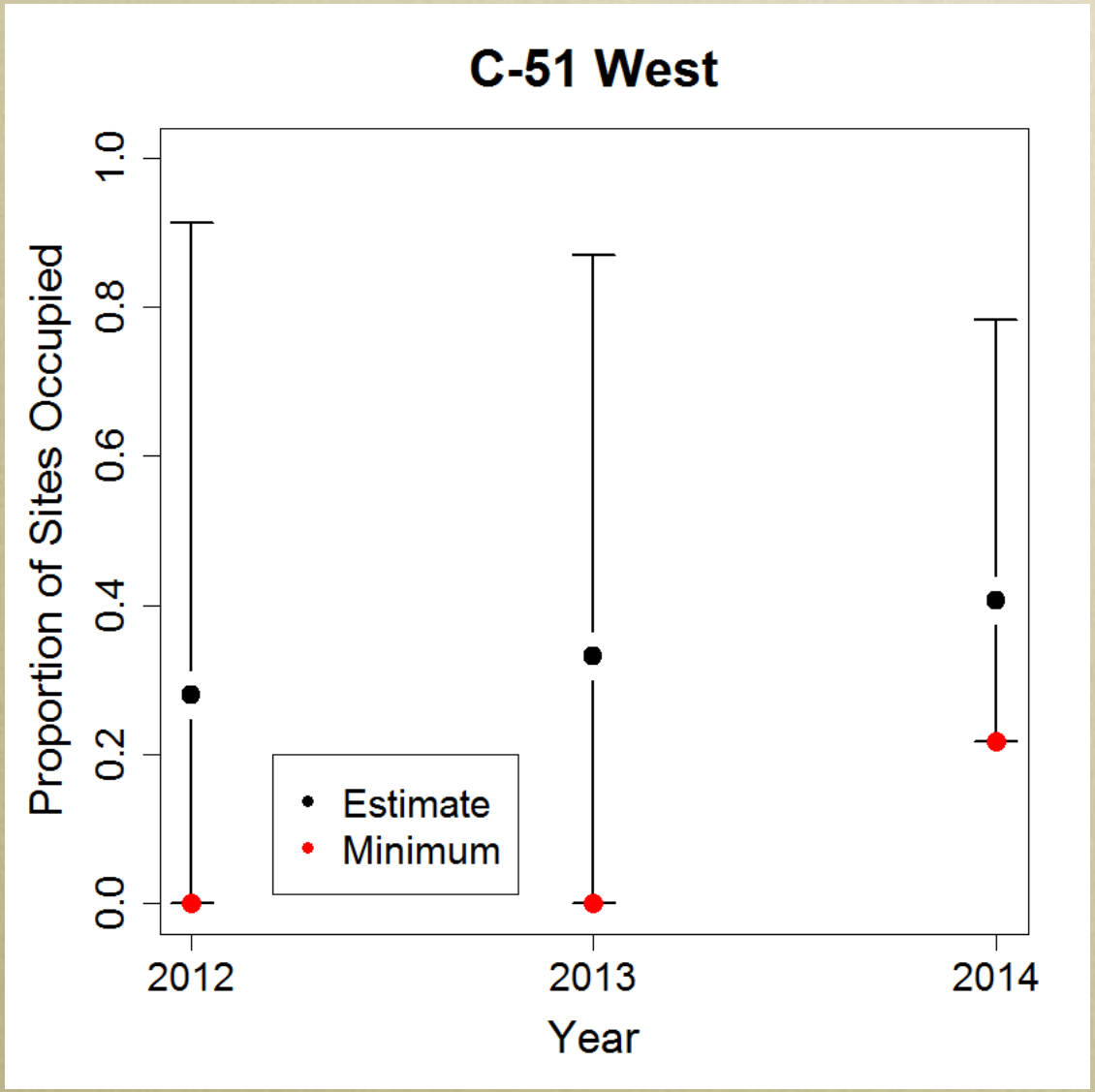
- Transects divided into segments as spatial replicates (sites)
  - 35 sites for C-51 East
  - 23 sites for C-51 West
- Each segment classified as Dense, Mixed or Open vegetation
- Segment length averaged 650 m (range: 210-905 m)

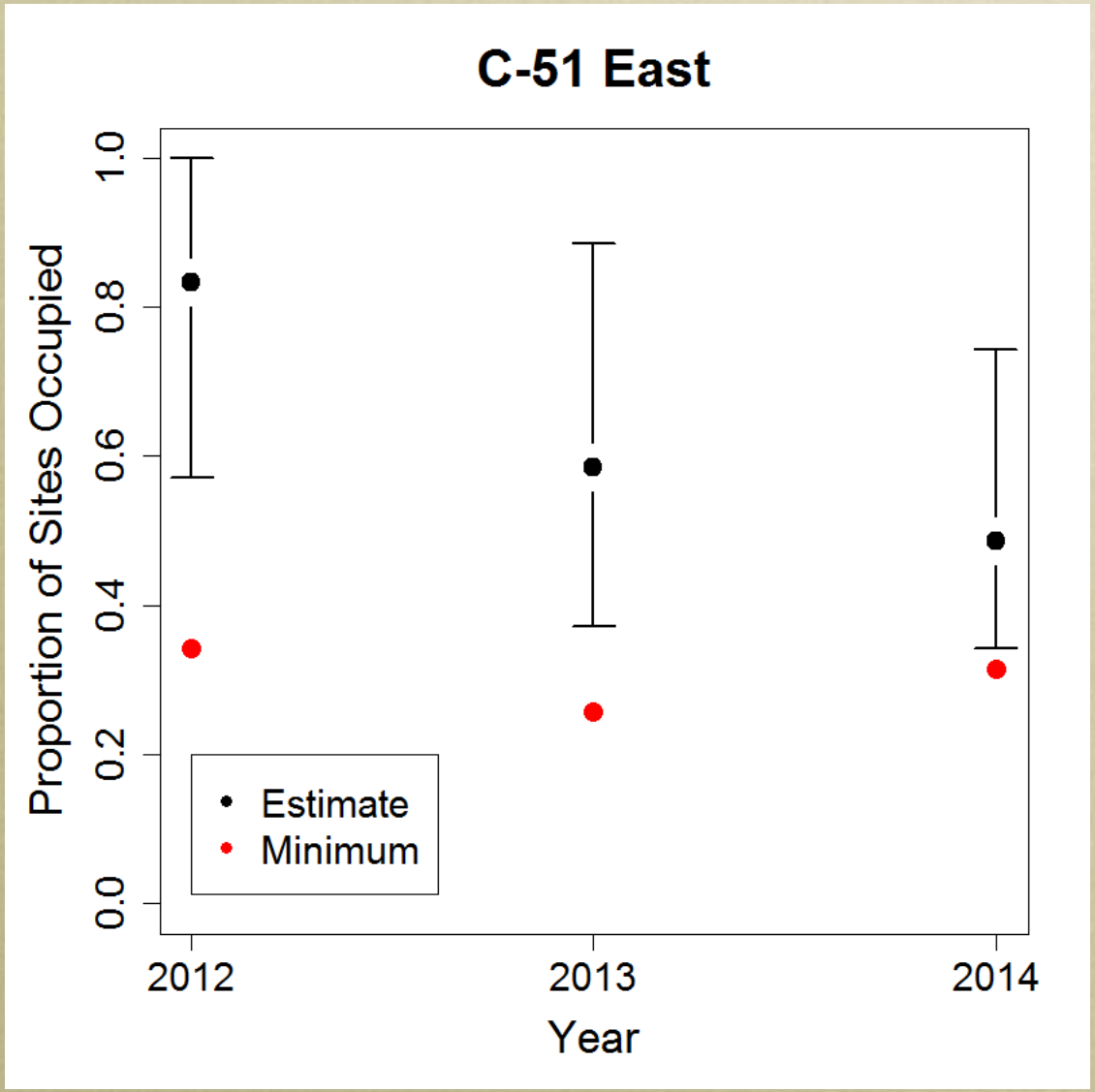
Site Occupancy Analysis

- C-51 East and West analyzed separately
- Estimates for years 2012—14
- Vegetation class tested as a covariate for site occupancy probability
- Detection probability modeled as constant across all 3 years
- Models fit using Bayesian hierarchical model in Program WinBUGS from Program R

Results

- Detection Probability
  - For C-51 East: **0.048** (95% CI: 0.031-0.069)
  - For C-51 West: **0.059** (95% CI: 0.020-0.130)
  - Thus there is about a 5% chance of detecting a monitor on a survey when they are present.
- Site Occupancy
  - No evidence that vegetation class had an effect on occupancy.

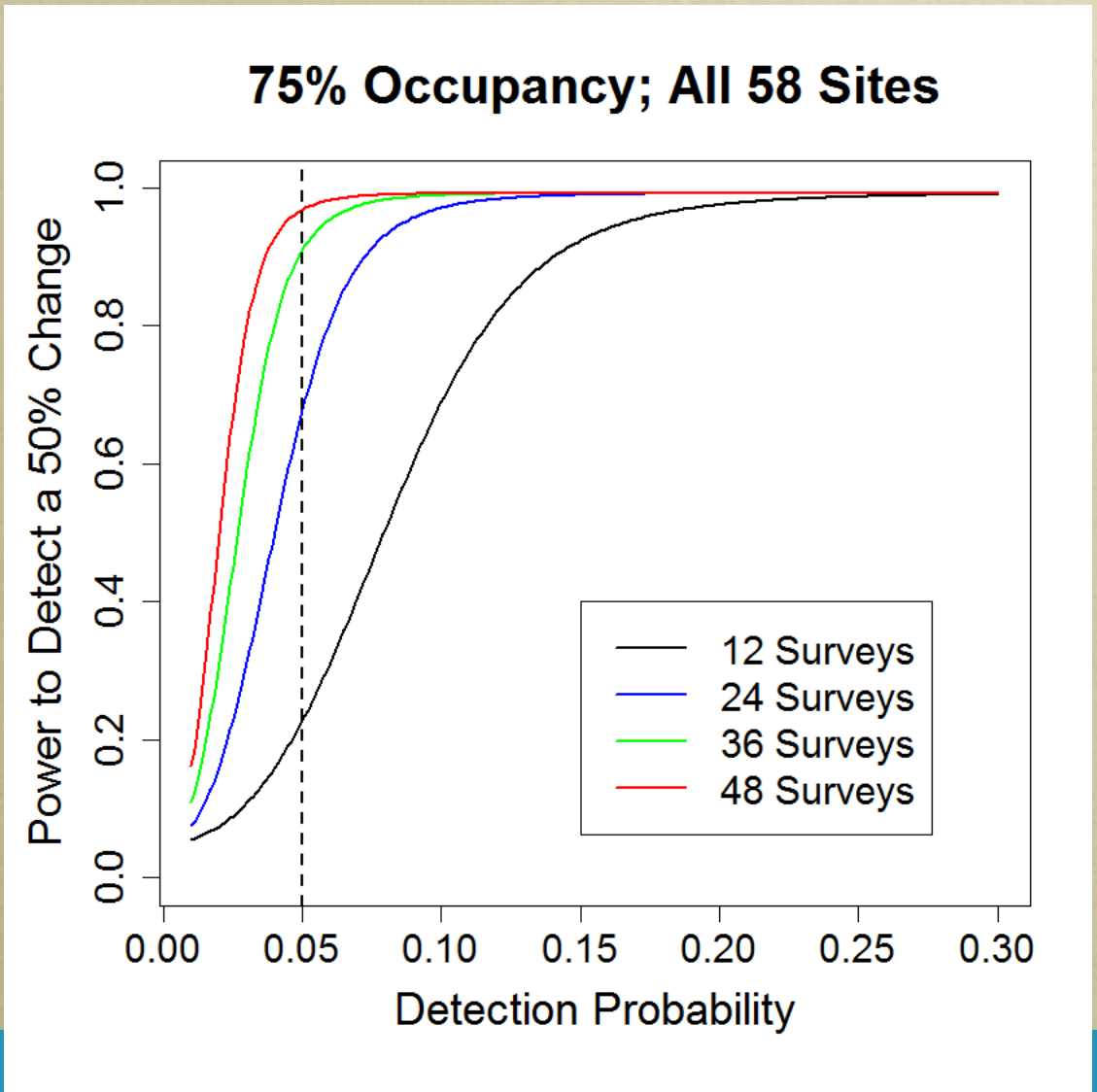

C-51 West
Proportion of Sites Occupied
0.0
0.2
0.4
0.6
0.8
1.0
Estimate
Minimum
2012
2013
2014
Year


C-51 East
Proportion of Sites Occupied
0.0
0.2
0.4
0.6
0.8
1.0
Estimate
Minimum
2012
2013
2014
Year

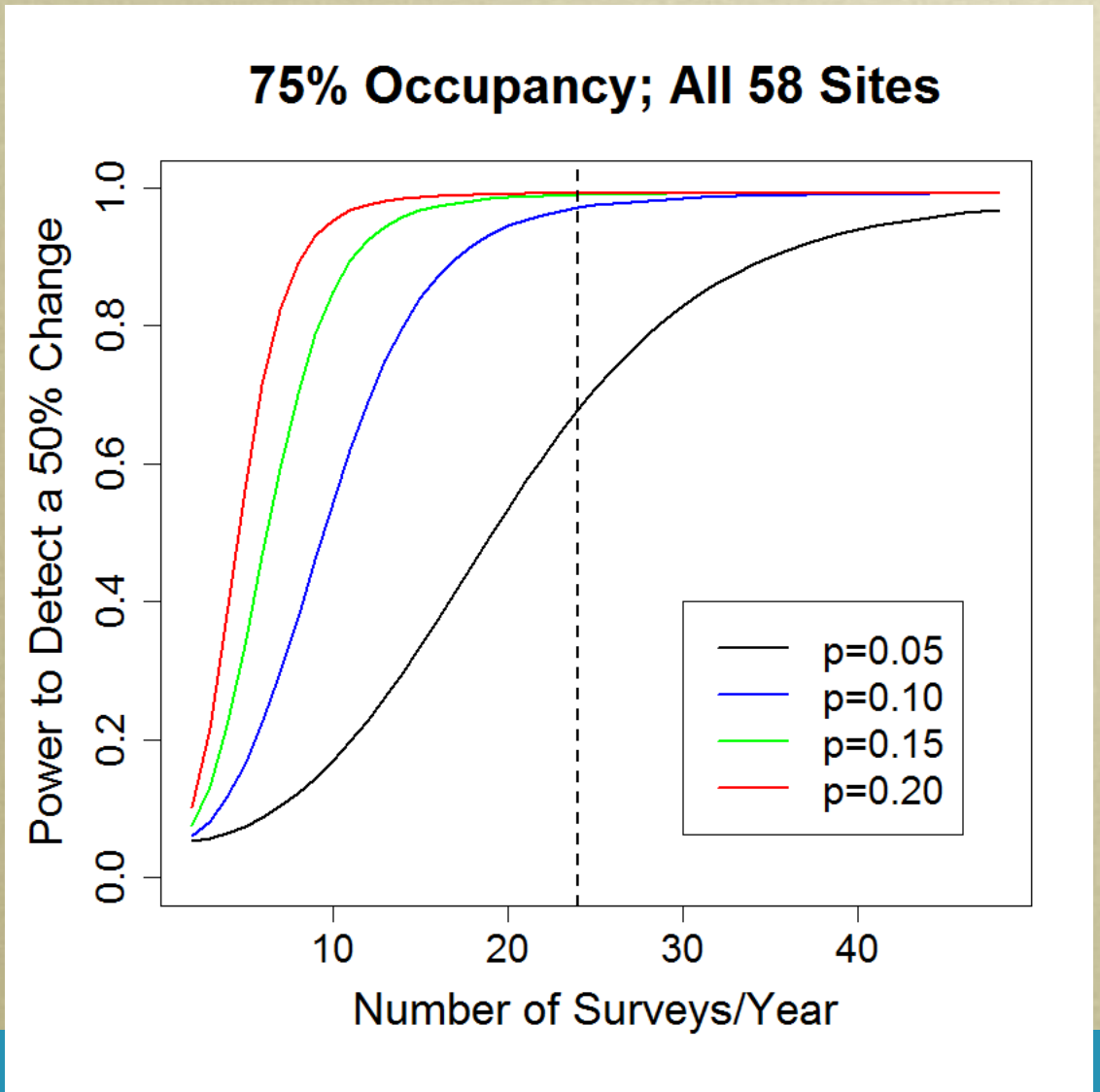
Power Analysis

- Calculates the statistical power of the study design to detect a change in site occupancy
- Given the estimated detection and occupancy of 2014 at C-51 East with 24 surveys/year:
  - Power to detect a 50% change in occupancy: **0.27**
  - We would have only a 27% chance of detecting a 50% change in occupancy!

How do we improve? More surveys?

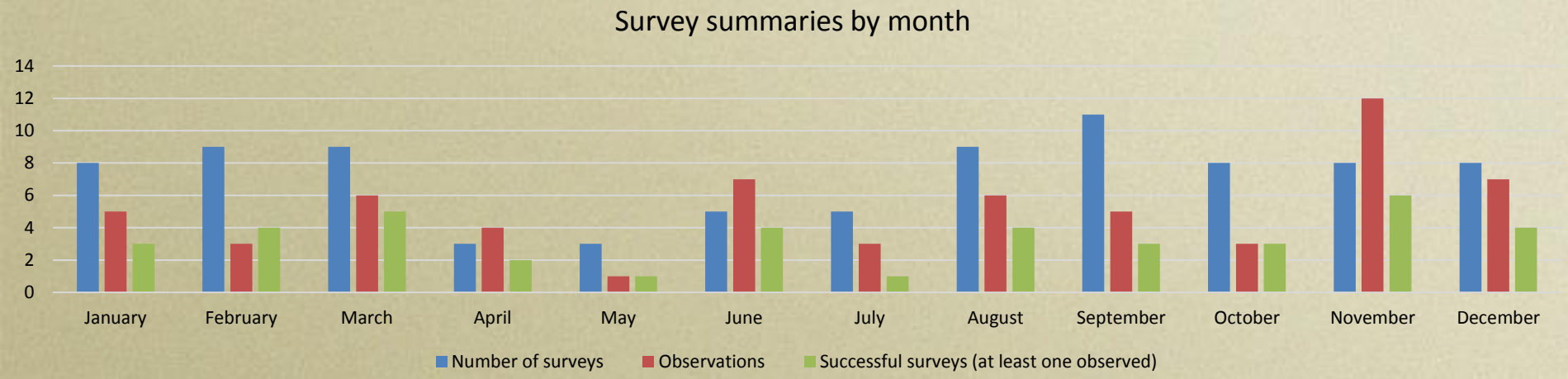


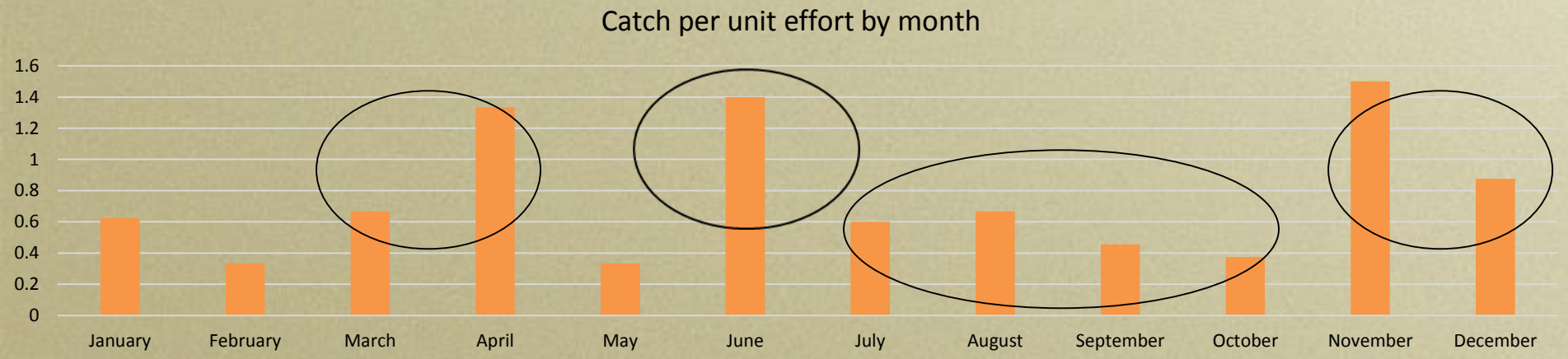
The answer: Better detection





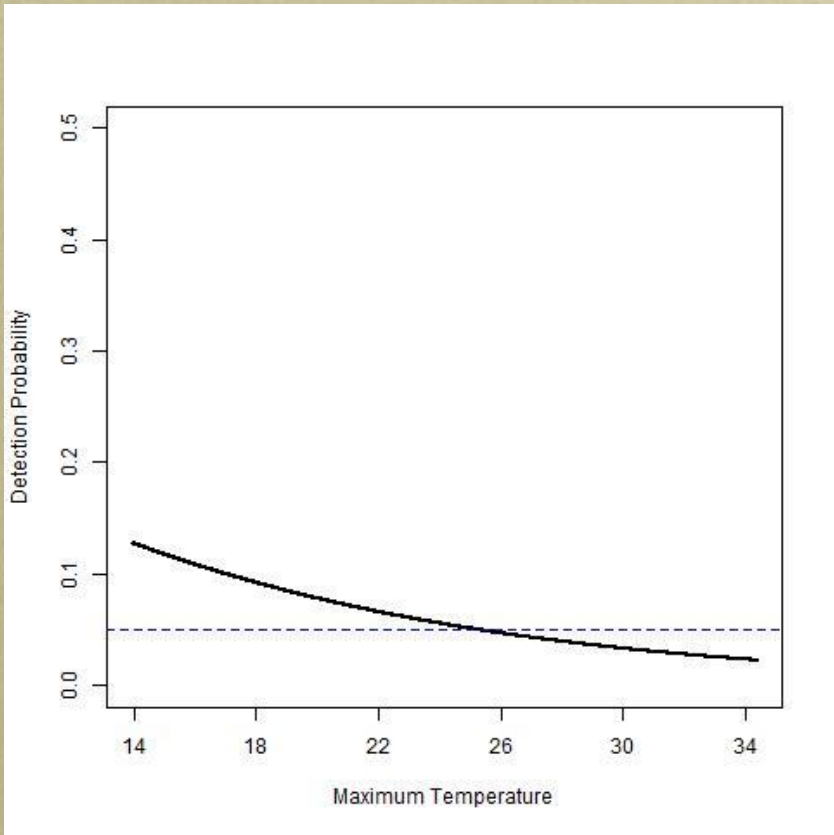

Results by month, 2012–15



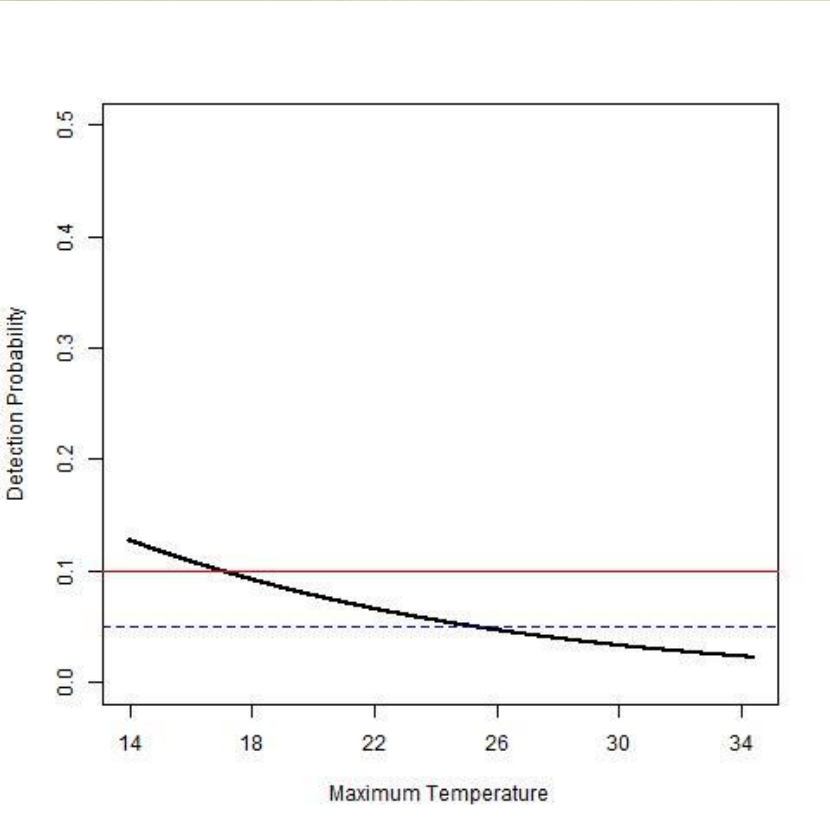


Effect of temperature

Detection probability of 0.05



Detection probability of 0.1



Management implications

- Could reduce number of surveys on C-51 E
- Survey more on C-51 W
- Skip some months and increase surveys during prime months
- Improving detection
  - Go slow in both directions of the survey
  - Always have multiple experienced, observers
  - Temperature

Additional research needed

- Effect of atmospheric pressure and daily change in pressure on detectability
- Diet analysis
- Reproductive cycle
- Improving live trapping techniques

Questions?