



- LCR MSCP -



**Southwestern Willow Flycatcher
Demography and Ecology Studies
along the Lower Colorado River and Tributaries
2003–2007**



SWCA[®]

ENVIRONMENTAL CONSULTANTS

Outline

- Presence/absence surveys; distribution and numbers



- Microclimate/vegetation



- Cowbird trapping



- Demographics

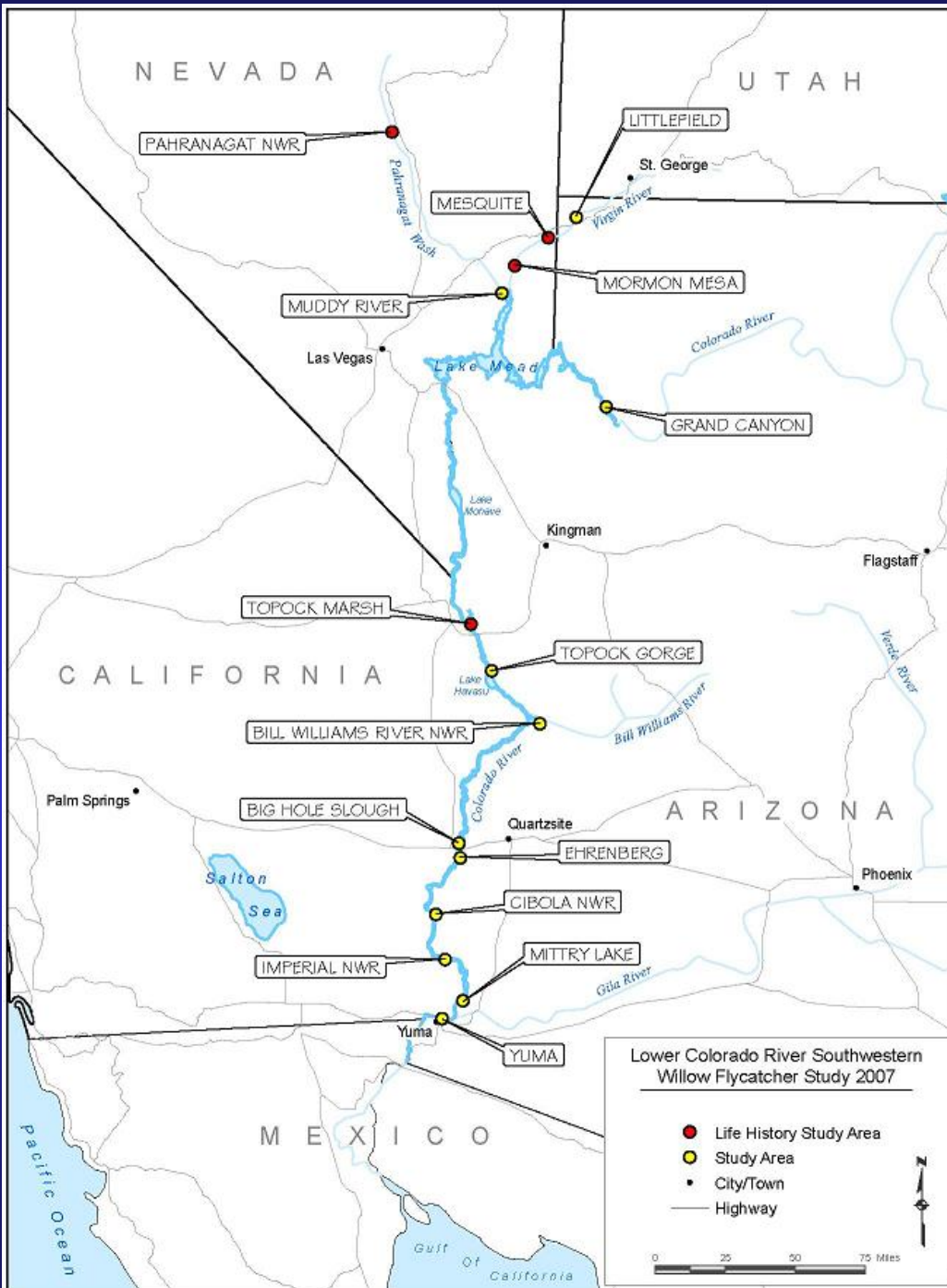


Study Area:

Approx. 100 survey sites



Sites chosen by field recon via helicopter, boat, and on foot





Breeding sites

Pahrnagat – native

Mesquite – mixed-native

Mormon Mesa – mixed-exotic

Muddy River – mixed-exotic

Topock – exotic

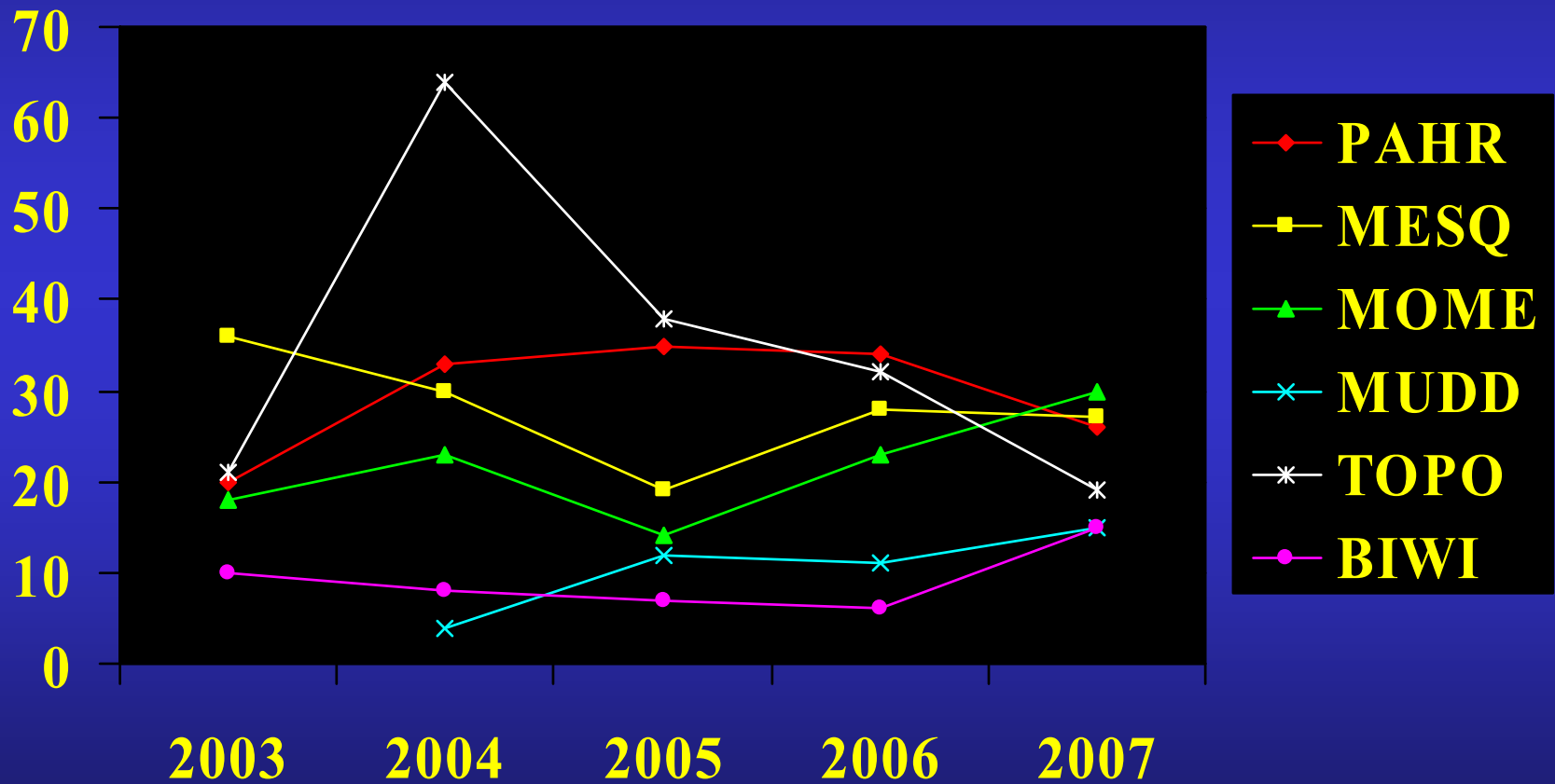
Bill Williams – mixed-native

Grand Canyon – mixed-exotic

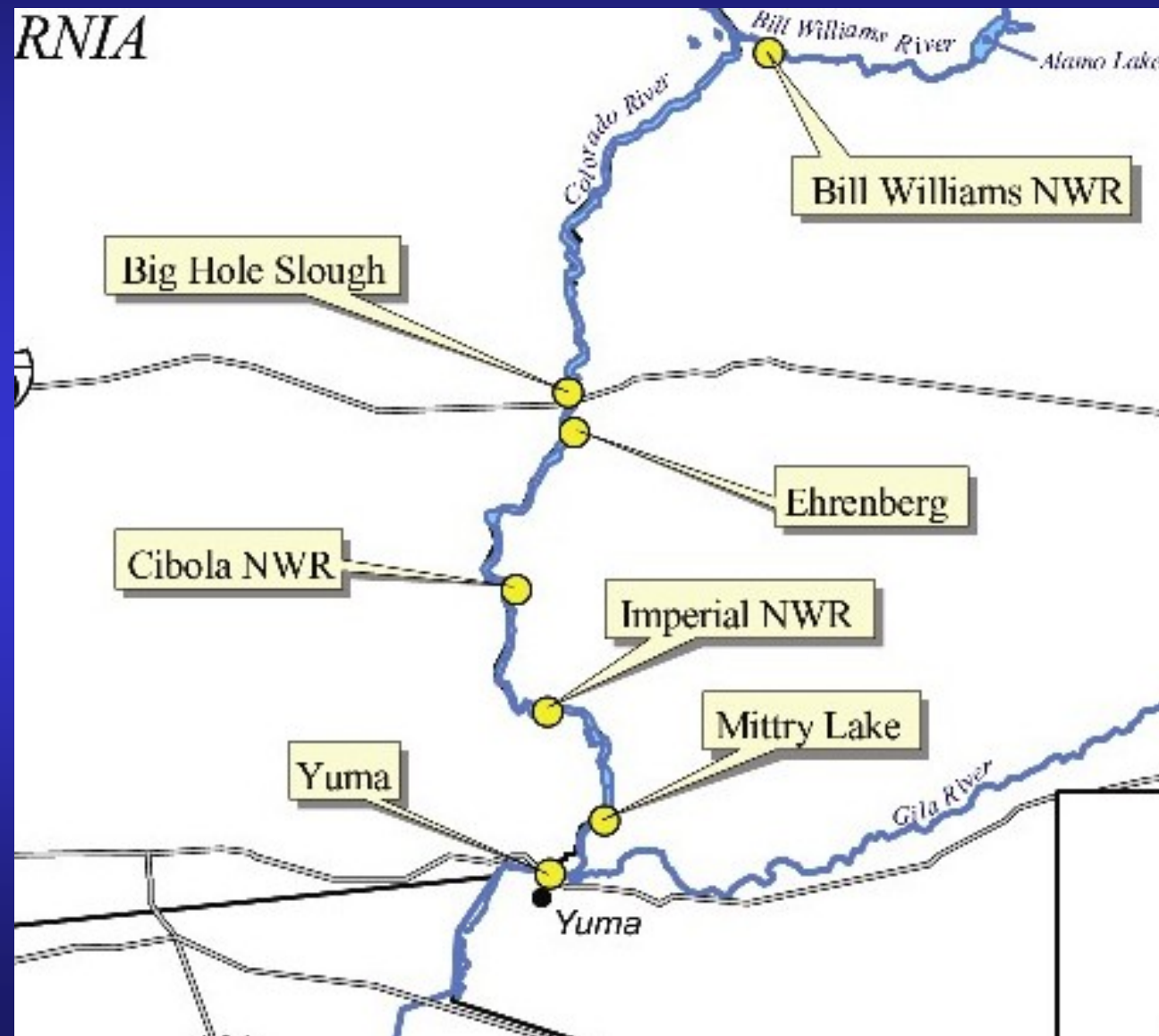
Littlefield – mixed-native



Resident Adult Flycatchers



Flycatchers South of Bill Williams



- No resident willow flycatchers recorded south of Bill Williams

- Southern LCR major flyway for northbound migrant flycatchers

* waves of migrants, up to 600 detections recorded annually

* degree to which *extimus* uses this migration habitat unknown

Cowbird Trapping



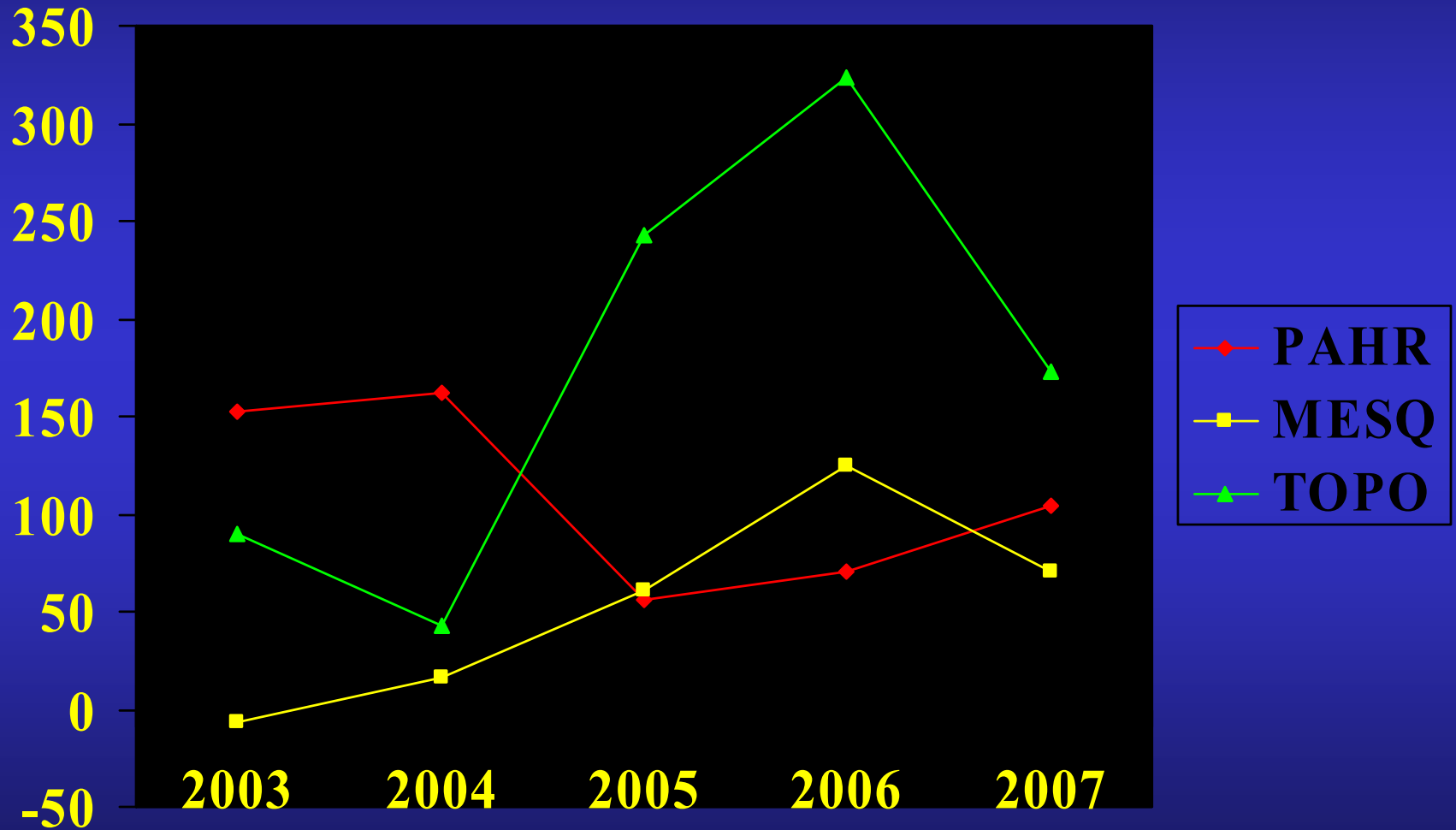
Brood parasites



Trapped annually 2003–2007 at PAHR, MESQ, and TOPO

Compared nest success parameters during trapping (2003–2007) with those recorded at those study areas prior to trapping (1997–2002)

Cowbirds Removed



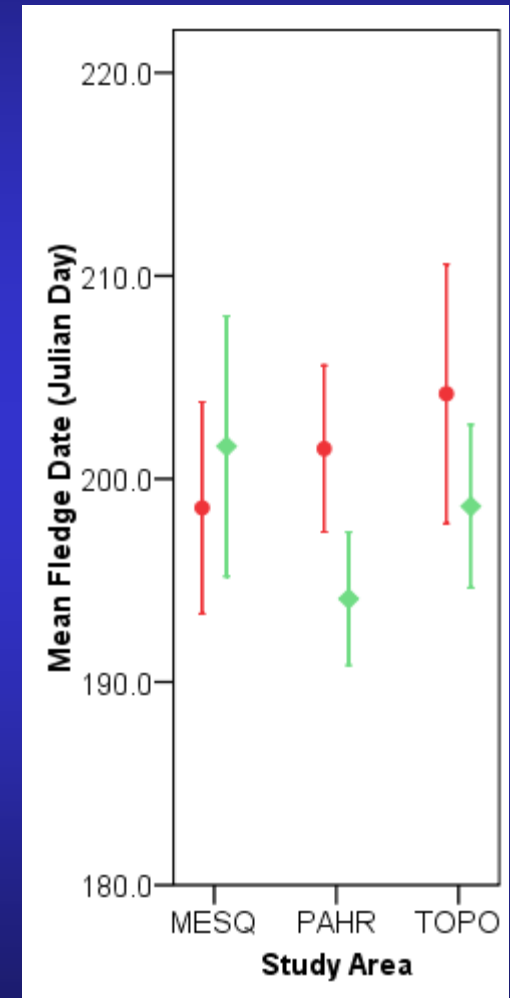
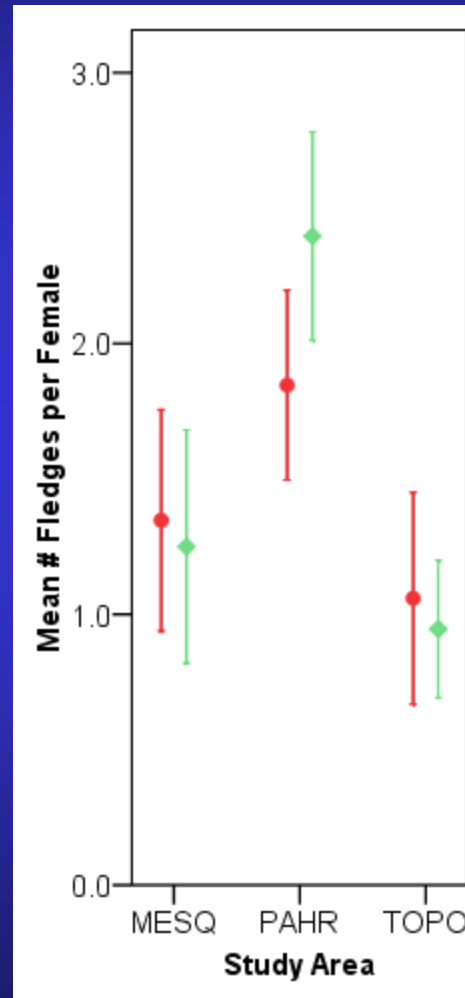
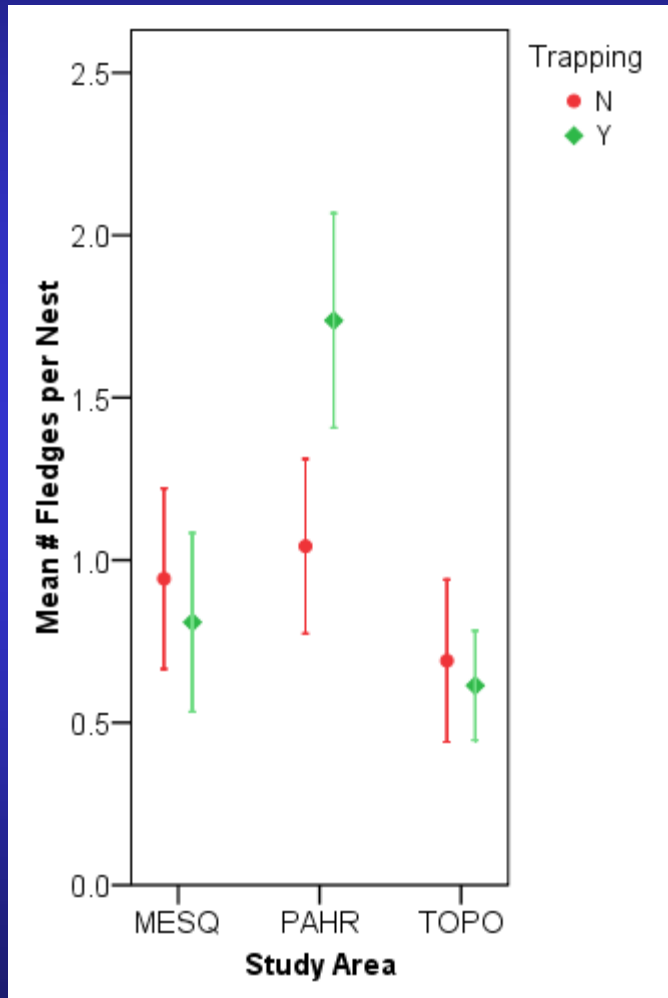
Nesting and Productivity Parameters Pre-trapping vs Trapping

Study Area	Parasitism Rate		Nest success	
	Pre-trapping	Trapping	Pre-trapping	Trapping
PAHR	17.9	0.0	52.6	68.9
MESQ	33.3	33.3	48.5	45.9
TOPO	25.0	34.5	42.6	41.7

Parasitism rate lower during trapping period at PAHR

Nest success higher during trapping period at PAHR

Nesting and Productivity Parameters Pre-trapping vs Trapping



Why Pahranaagat??

Landscape characteristics:
Small, isolated site

In contrast to Mesquite and
Topock
Large riparian corridors

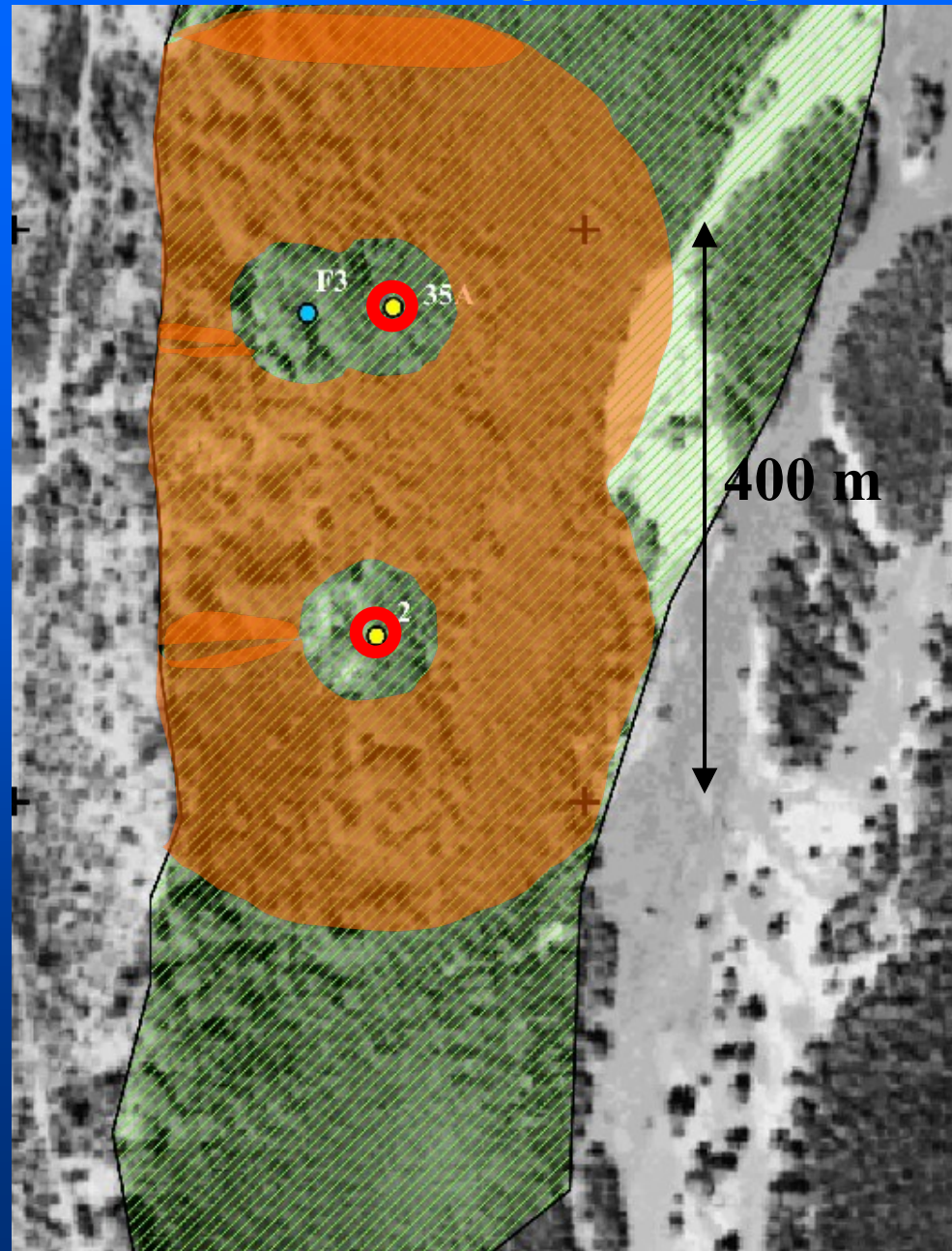
More likely that the cowbirds we
trap are the ones parasitizing
nests

Local cowbird population may be
less likely to be replaced by new
individuals over the season



Vegetation and Microclimate Study Design

– NS = Nest Site



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Measurements at end of
season

Vegetation and Microclimate Data Analysis

- Pooled data across years
- Excluded Pahranaagat
- Used a matched analysis, pairing each NS with its respective NU and WT and examining differences in microclimate and vegetation variables between NS and WT as well as NS and NU
- After analyzing differences between NS/WT and NS/NU for individual variables, used a conditional logistic regression model to determine which variables were the strongest predictors of nest sites vs. within-territory and non-use locations.
- Used linear regression to examine the relationship between vegetation and microclimate characteristics.

Vegetation Results, Univariate Analysis

- NS > WT

 - stems 2.5–8 cm dbh

 - vertical foliage density above nest

- NS > NU

 - canopy height

 - canopy closure

 - stems 2.5–8 cm dbh

 - stems > 8cm dbh (within 5-m-circle and 5-11 m circle)

 - percent basal area native

 - vertical foliage density above the nest

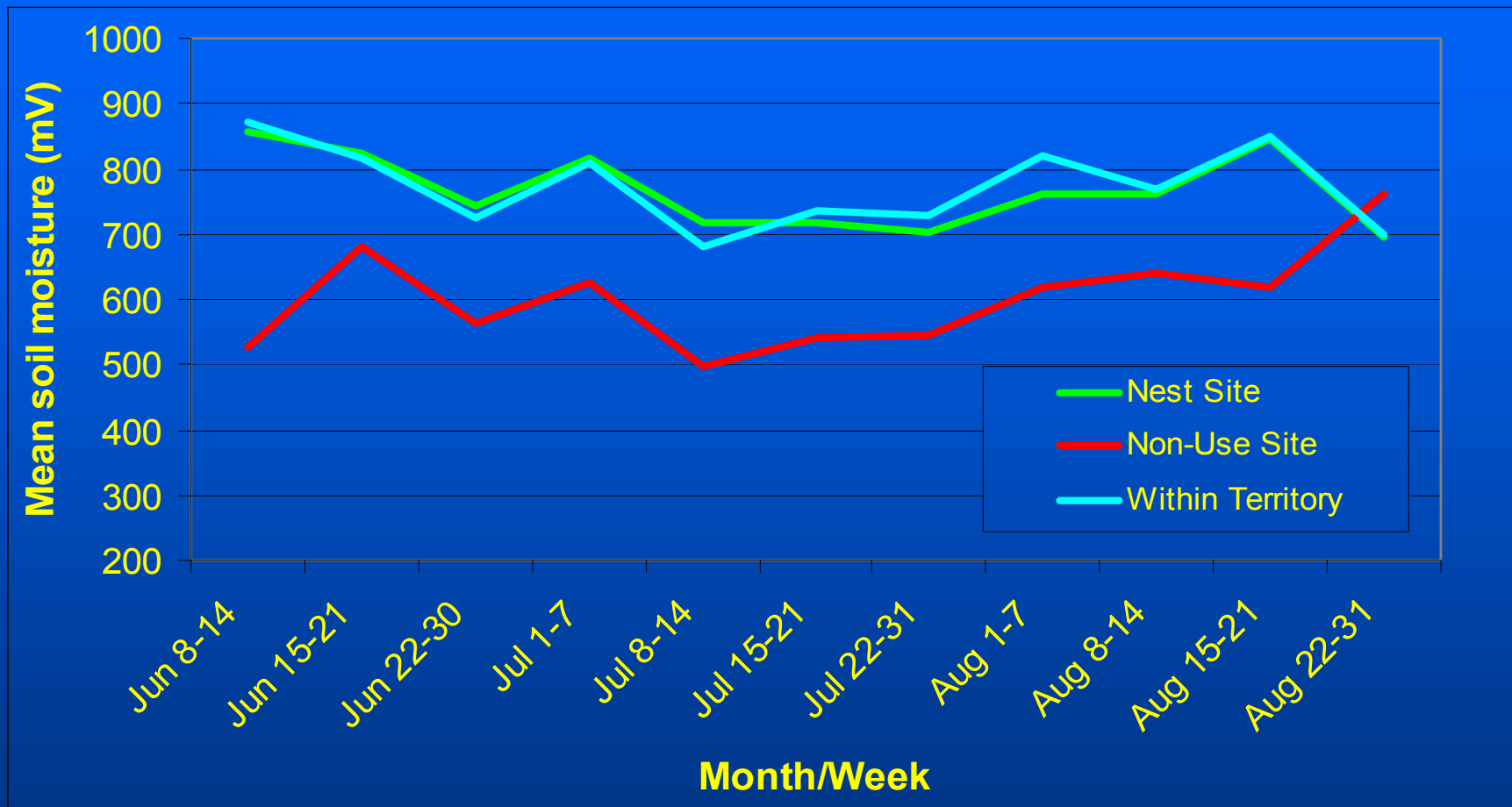
- NS < NU

 - percent woody ground cover

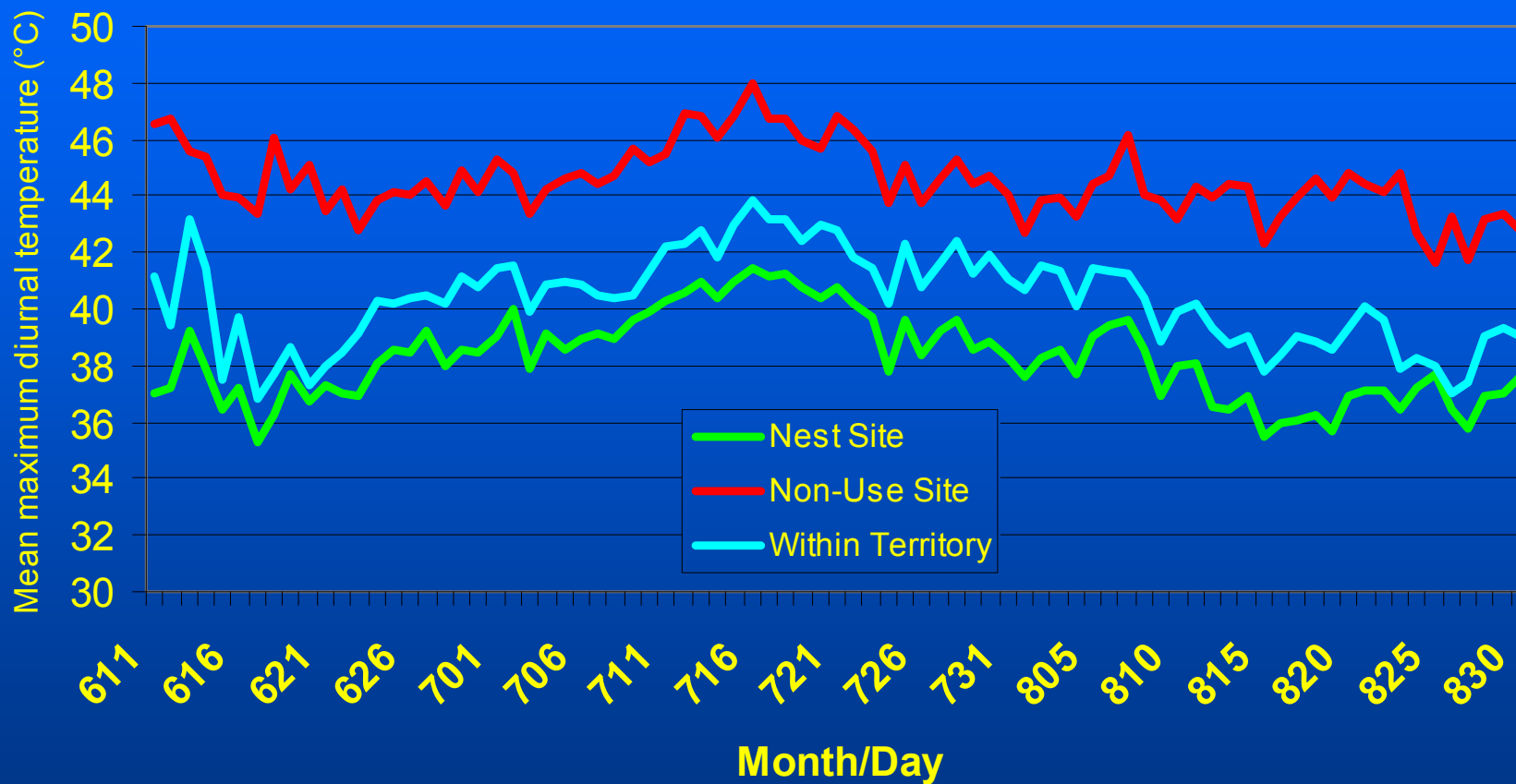
 - distance to water during nesting

 - distance to nearest broadleaf tree

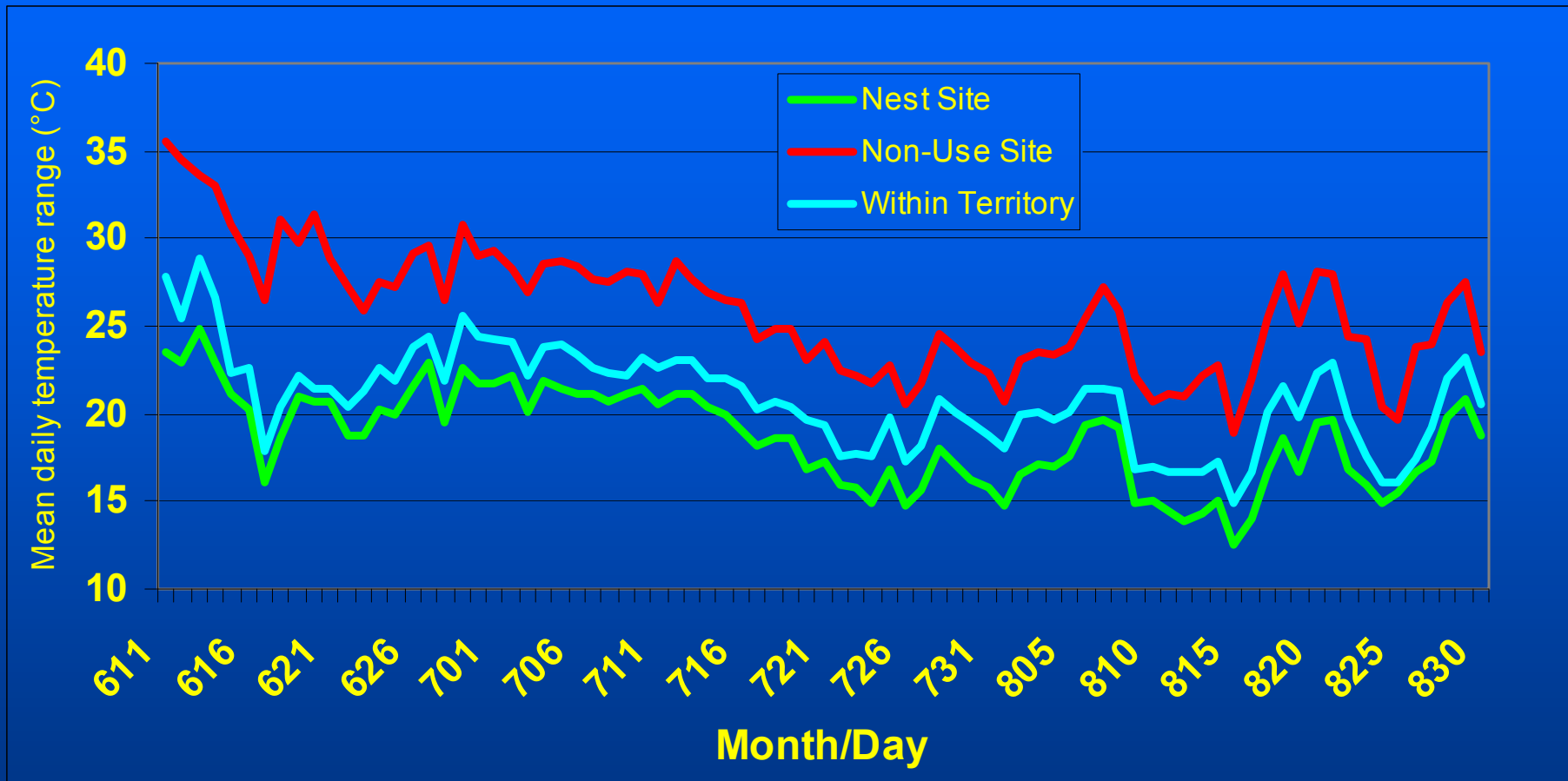
Microclimate Results, Univariate Analysis



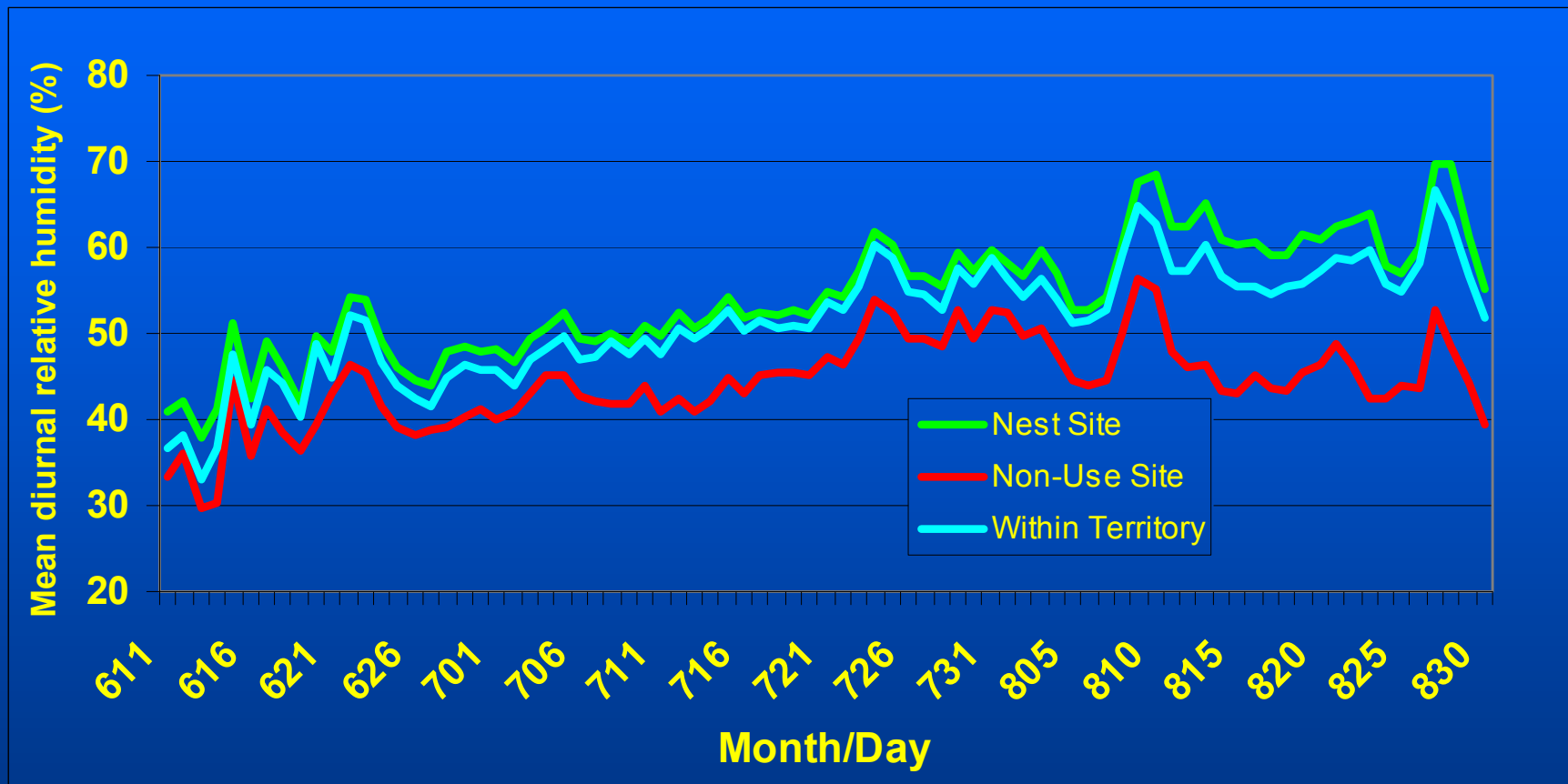
Microclimate Results, Univariate Analysis



Microclimate Results, Univariate Analysis



Microclimate Results, Univariate Analysis



Microclimate and Vegetation Results, Multivariate Analysis

- NS vs. WT

 - Mean daily temperature range

 - Canopy height

- NS vs. NU

 - Mean diurnal vapor pressure

 - Canopy height

 - Vertical foliage density above the nest

Association Between Microclimate and Vegetation

Explanatory Variables	Mean diurnal temperature (°C)	Mean minimum nocturnal temperature (°C)	Mean daily temperature range (°C)	Mean diurnal vapor pressure (Pa)
Canopy height (m)	-	-		-
Canopy closure (%)	-		-	+
No. shrub stems (0–2.5 cm dbh)	+		+	
No. shrub stems (2.5–8.0 cm dbh)	-		-	+
No. tree stems (> 8.0 cm dbh)		+	-	
Percent native basal area	-		-	
Vertical foliage density above nest		+	-	
Vertical foliage density at nest				
Vertical foliage density below nest				-

Management Recommendations

Vegetation Variables	Recommended Management Action
Canopy height (m)	increase
Canopy closure (%)	increase
No. shrub stems (<2.5 cm dbh)	minimize
No. shrub stems (2.5–8.0 cm dbh)	increase
No. shrub stems (>8.0 cm dbh)	increase
Proportion basal area that is native (%)	increase
Vertical foliage density above nest	increase
Vertical foliage density at nest	ignore
Vertical foliage density below nest	minimize

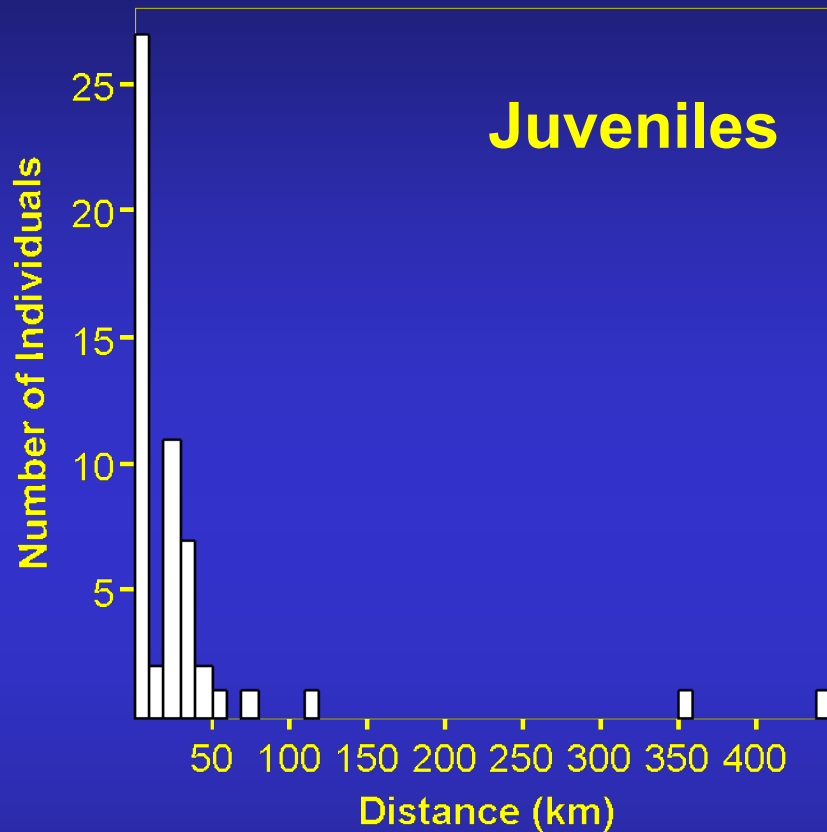
Demographics

- Color-banding 1997–2007
 - Unique color combinations, allows ID to individual
- Movement patterns
 - Adults and juveniles
- Calculate estimates for survival and detection probabilities
 - Gender
 - Age
 - Location
- Calculate estimates for annual rate of population change (λ)
 - Location

Demographics

- 1997–2006
 - 267 adults and 504 juveniles banded
 - 289 between-year adult returns
 - 107 juveniles detected in a subsequent year
- Dispersal distance calculated using 2003–2007 data
- All data (1997–2007) used for survival and λ estimates
- Program MARK

Juvenile and Adult Movement

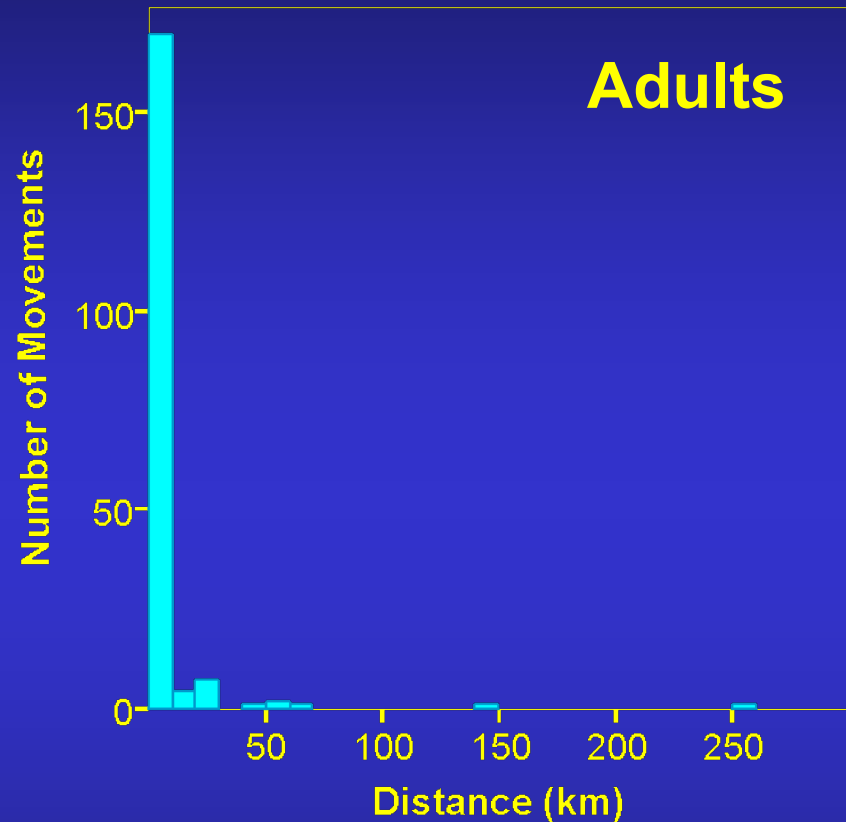


Mean 31.7 km

Median 7.6 km

Minimum 0.02 km

Maximum 444.0 km



Mean 4.9 km

Median 0.07 km

Minimum 0.003 km

Maximum 258.5 km

Adult Survival and Detection

- Effects of gender?

No strong evidence that gender had an effect

Therefore pooled genders for further analyses

- Effects of location?

Grouped in 3 regions, based on geographic proximity and observed movements:

N = Nevada

V = Virgin

H = Havasu



Adult Survival and Detection

- Effects of location and year?

Survival and detection both differed by area but did not differ by year.

Nevada			Virgin			Havasu			Ψ
n	Φ	p	n	Φ	p	n	Φ	p	
120	60 (51-67)	77 (64-86)	163	59 (52-66)	80 (70-87)	96	41 (32-51)	88 (58-98)	0.3 0-0.8

Juvenile Survival and Detection

- Used the same geographic groupings

Survival constant across areas and years; detection differed by area but not by year.

Nevada			Virgin			Havasu			Ψ
n	Φ	p	n	Φ	p	n	Φ	p	
149	37 (29–46)	30 (16–48)	213	37 (29–46)	48 (34–61)	142	37 (29–46)	25 (14–41)	4.0 2–8

Annual Rate of Population Growth

$\lambda = \text{adult survivorship} + (\text{juvenile survivorship} \times \text{seasonal fecundity}/2)$

Nevada Year	Survivorship (%)		Fecundity	λ
	Adult	Juvenile		
1997–1998	59.9	36.8	--	--
1998–1999	59.9	36.8	2	0.97
1999–2000	59.9	36.8	2.3	1.02
2000–2001	59.9	36.8	2.1	0.98
2001–2002	59.9	36.8	1.6	0.90
2002–2003	59.9	36.8	1	0.78
2003–2004	59.9	36.8	3	1.15
2004–2005	59.9	36.8	2.5	1.06
2005–2006	59.9	36.8	3	1.15
2006–2007	59.9	36.8	1.6	0.89
Overall	59.9	36.8	2.1	0.99

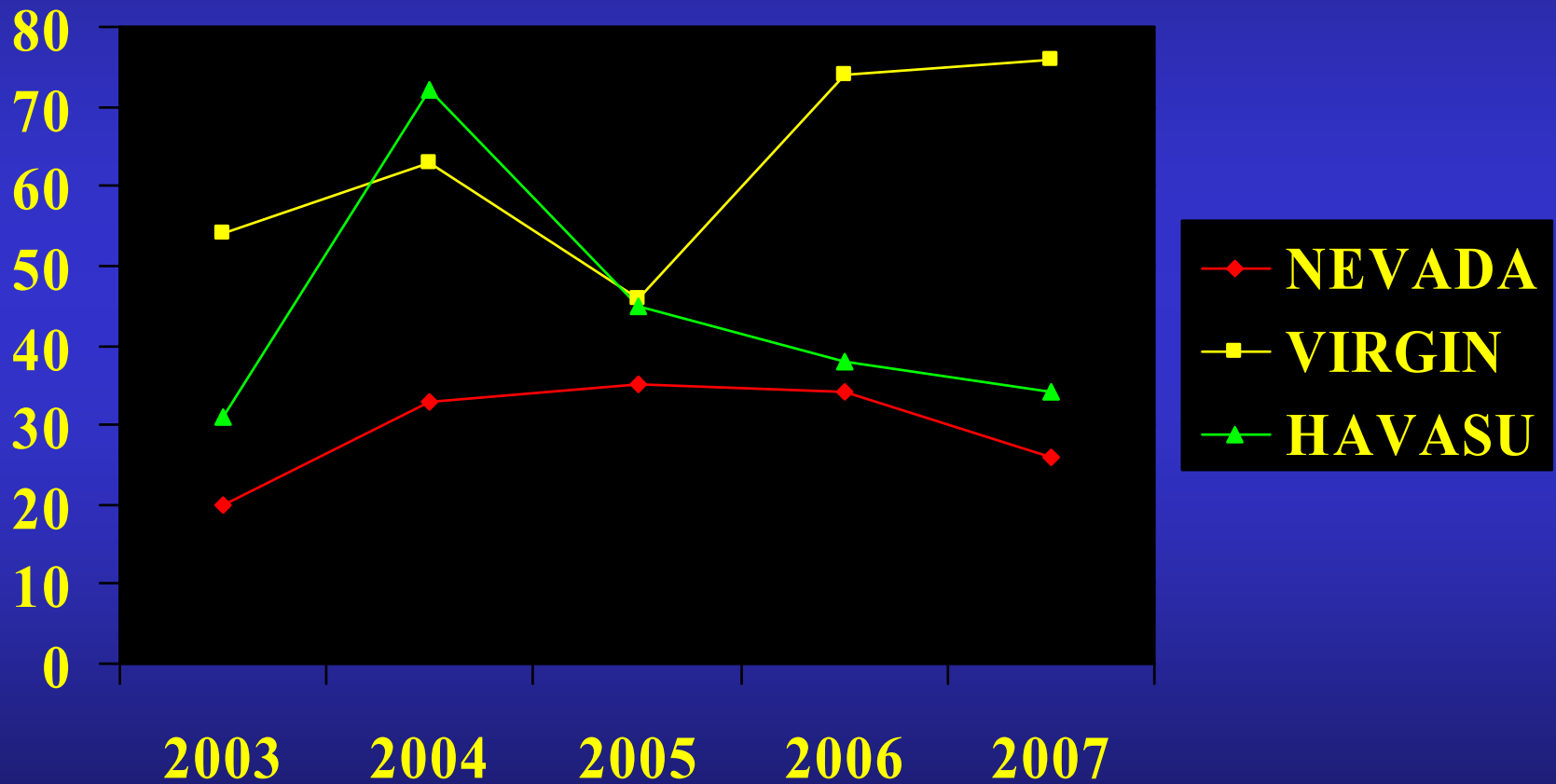
Annual Rate of Population Growth

Virgin	Survivorship (%)		Fecundity	λ
Year	Adult	Juvenile		
1997–1998	59.3	36.8	1.1	0.79
1998–1999	59.3	36.8	1.3	0.83
1999–2000	59.3	36.8	1.0	0.78
2000–2001	59.3	36.8	0.9	0.76
2001–2002	59.3	36.8	1.4	0.84
2002–2003	59.3	36.8	1.1	0.80
2003–2004	59.3	36.8	0.9	0.75
2004–2005	59.3	36.8	1.0	0.77
2005–2006	59.3	36.8	0.7	0.72
2006–2007	59.3	36.8	1.2	0.80
Overall	59.3	36.8	1.0	0.77

Annual Rate of Population Growth

Havasu Year	Survivorship (%)		Fecundity	λ
	Adult	Juvenile		
1997–1998	41.4	36.8	--	--
1998–1999	41.4	36.8	1.4	0.68
1999–2000	41.4	36.8	0.9	0.58
2000–2001	41.4	36.8	0.7	0.54
2001–2002	41.4	36.8	1.5	0.68
2002–2003	41.4	36.8	1.4	0.68
2003–2004	41.4	36.8	1.5	0.69
2004–2005	41.4	36.8	0.9	0.58
2005–2006	41.4	36.8	0.9	0.58
2006–2007	41.4	36.8	0.5	0.51
Overall	41.4	36.8	1.0	0.60

Resident Adult Flycatchers



Possible Errors in Lambda???

$\lambda = \text{adult survivorship} + (\text{juvenile survivorship} \times \text{seasonal fecundity}/2)$

- fecundity

 - Believe estimates are accurate

 - Recalculated λ using maximum fecundity; raised estimates ~4%

- juvenile survivorship (36.8%)

 - Could be underestimated

 - Similar to estimate obtained in central Arizona (34%)

- adult survivorship (41-60%)

 - Could be underestimated

 - Nevada and Virgin rates similar to estimate obtained in central Arizona (64%)

Possible Errors in Lambda???

λ = adult survivorship + (juvenile survivorship x seasonal fecundity/2)

- Immigration and emigration???

Permanent emigration accounted for in survivorship estimate

Did not include immigration because observed movement rates were so low (4% for juvenile, 0.3% for adults)

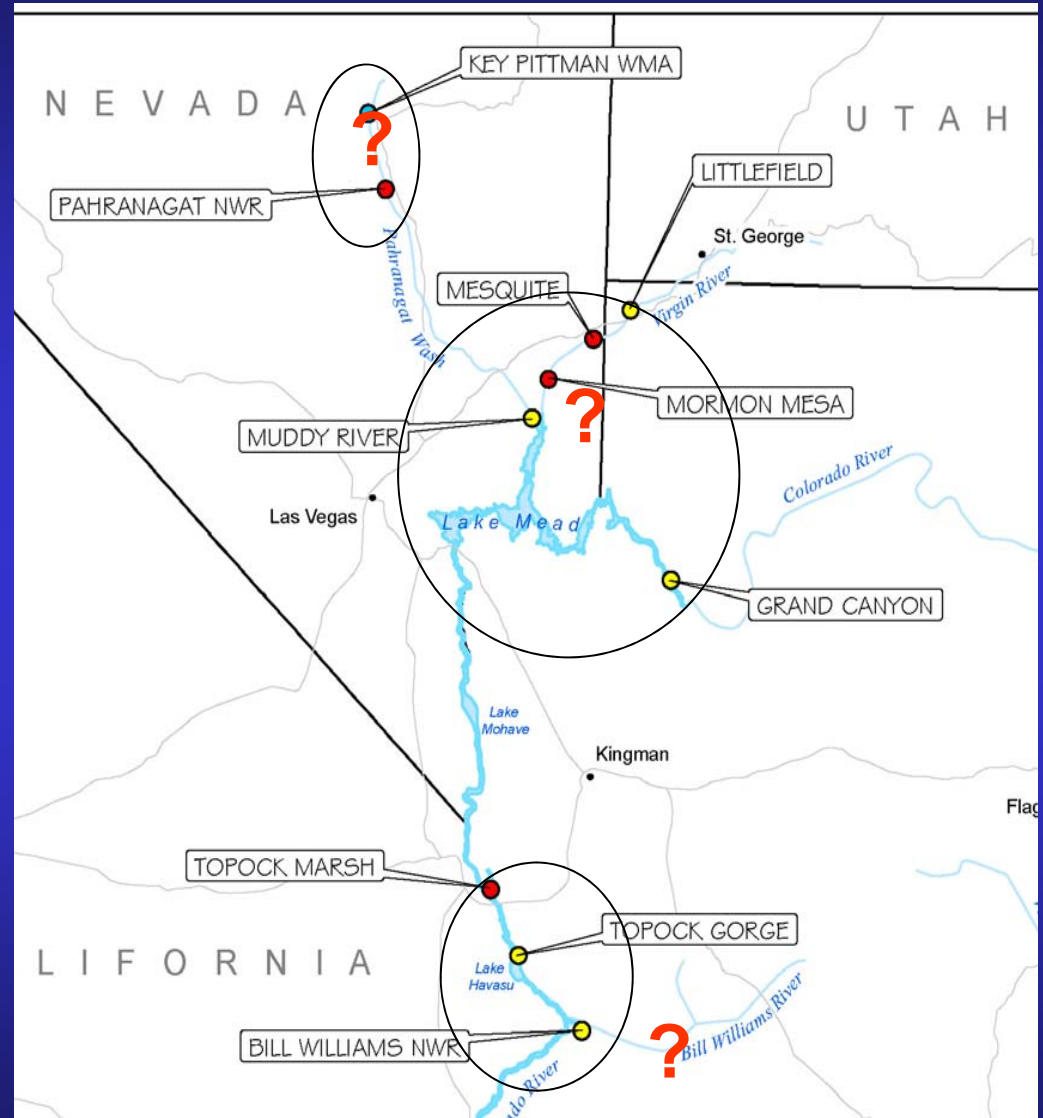
- Evidence for immigration at much higher rates

Number of unbanded adults detected at study areas each year far exceeds number of unbanded fledges documented in prior years

	Nevada	Virgin	Havasu
Fledges 2003-2006	23	4	17
Adults 2004-2007	40	67	36

Where are they coming from????????

- Alamo Lake
- Pahrnagat Valley
- Virgin River/Lake Mead?



Acknowledgements: *so many agencies and persons !*

- Bureau of Reclamation – Theresa Olson and John Swett
- USFWS Regions 1 and 2
- Federal Bird Banding Laboratory
- Arizona Game and Fish Dept.
- Nevada Division of Wildlife
- California Dept. of Fish and Game
- Refuges:

Pahrnagat NWR

Havasu NWR

Bill Williams River NWR

Cibola NWR

Imperial NWR

- Grand Canyon National Park
- Hualapai Tribe
- Lake Mead NRA
- Bureau of Land Management
- Cocopah Indian Tribe
- Key Pittman WMA
- Overton WMA
- Private landowners

Special thanks to our field crews.

Many thanks !!