

# Birds, water, and saltcedar: strategies for riparian restoration in the Colorado River Delta



THE UNIVERSITY OF ARIZONA,  
SCHOOL OF  
NATURAL RESOURCES  
COLLEGE OF AGRICULTURE AND LIFE SCIENCES



CIAD



PRBO  
CONSERVATION SCIENCE



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cedes



Reserva de la Biosfera  
ALTO GOLFO DE CALIFORNIA  
Y DELTA DEL RÍO COLORADO



SONORAN  
INSTITUTE



ENVIRONMENTAL DEFENSE

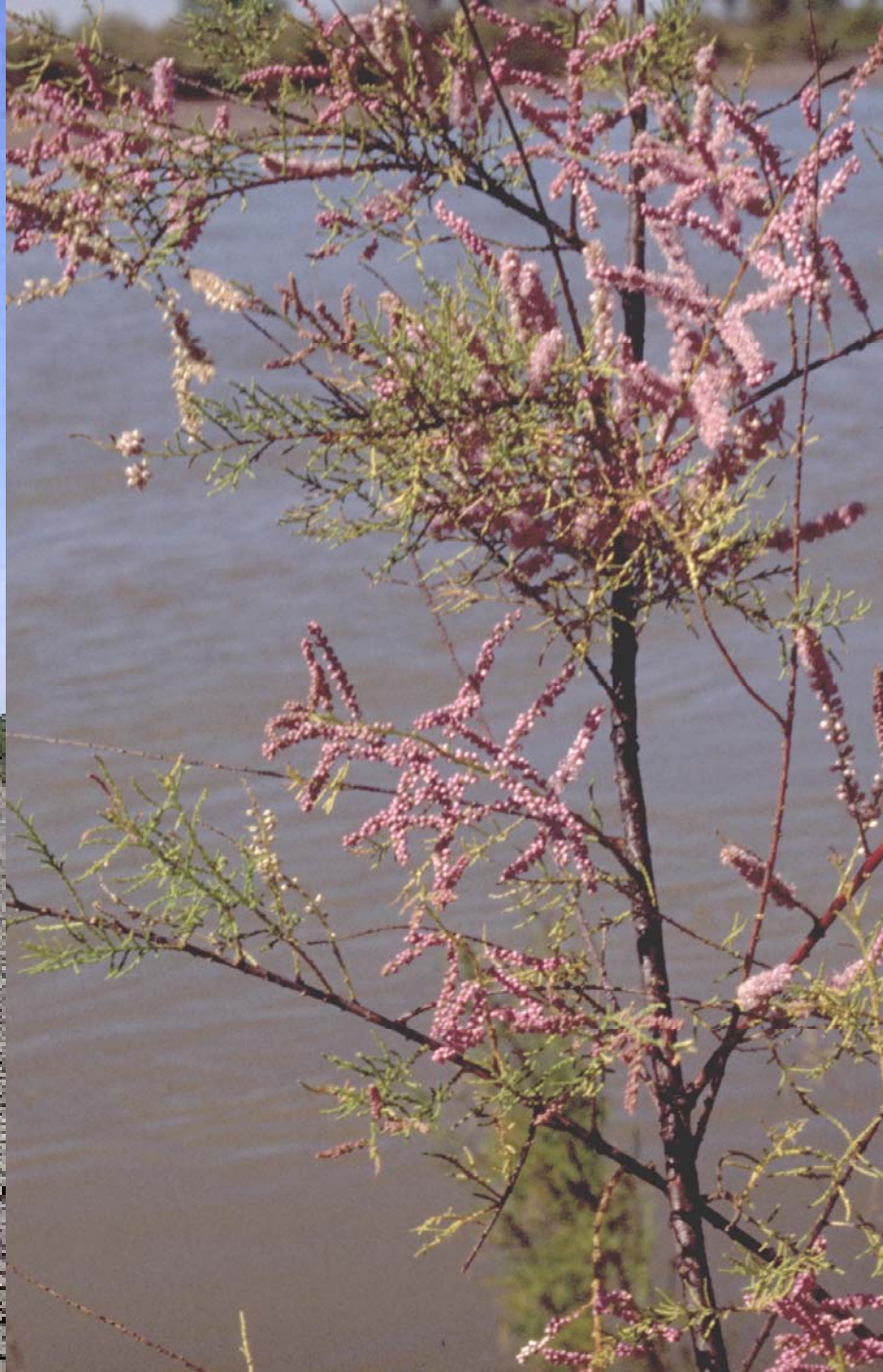
finding the ways that work



# Riparian Restoration in Western NA

- Loss of riparian and wetland areas
- More critical in the Sonoran Desert
- Population declines in at least 30 riparian dependant birds



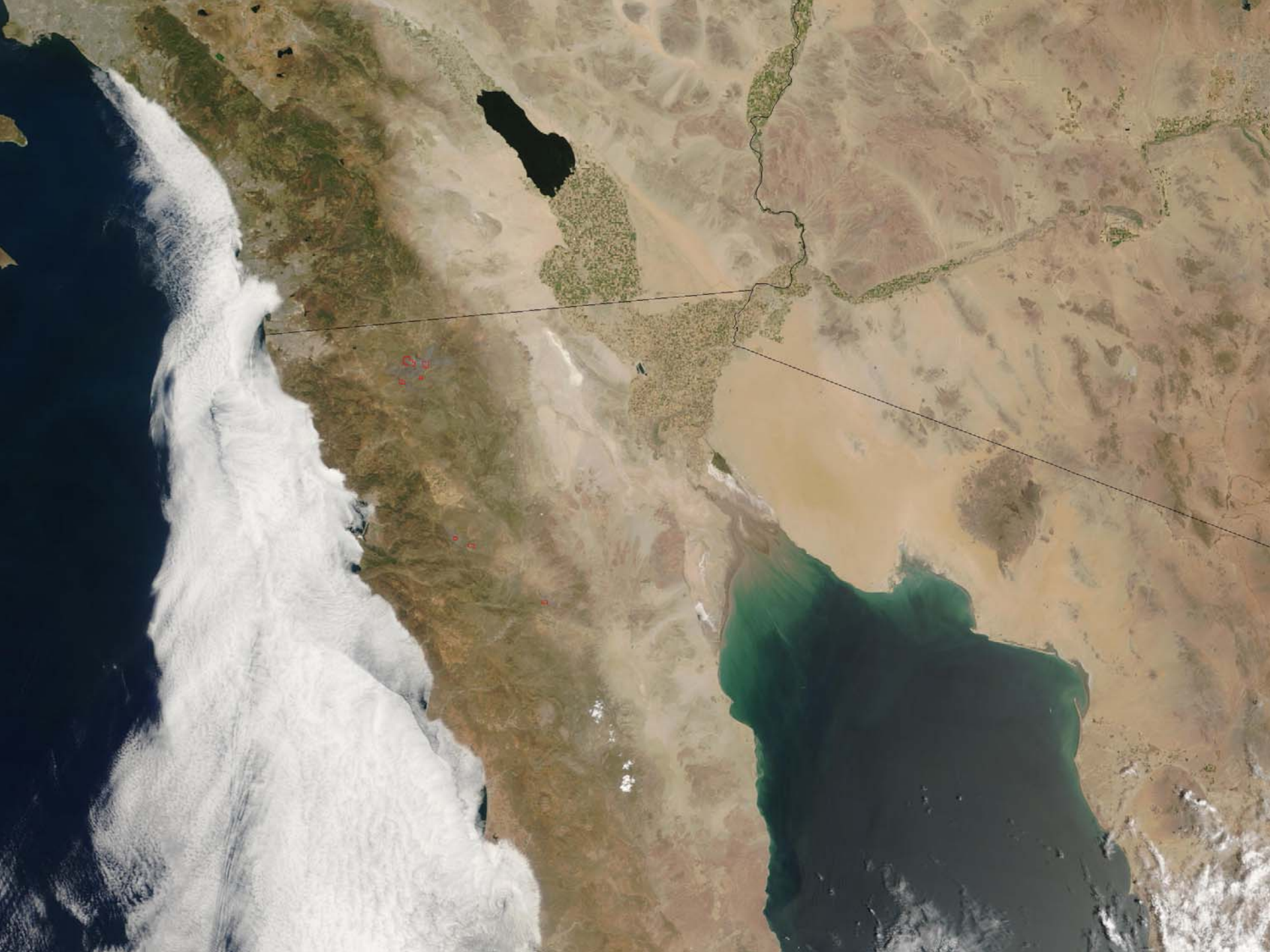






# Riparian Restoration in Western NA

- How do bird populations respond to pulse floods and regeneration events?
- Which strategies are best to enhance bird habitats in riparian areas?

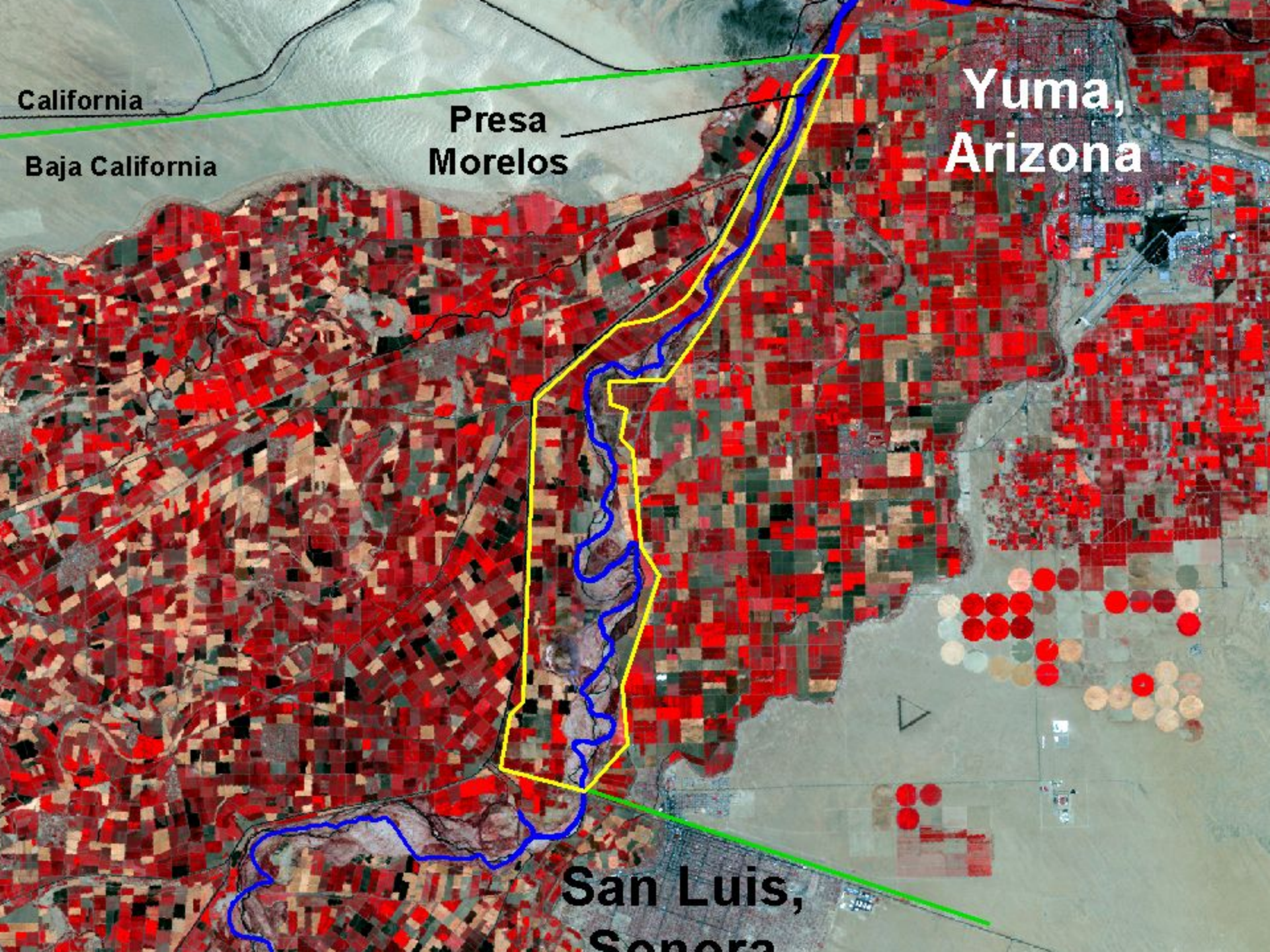




# Habitat Changes in the Colorado River Delta

- Dams and Water Diversions: Reduction of flows
- Agricultural Expansion
- 80% reduction in wetland area





California

Baja California

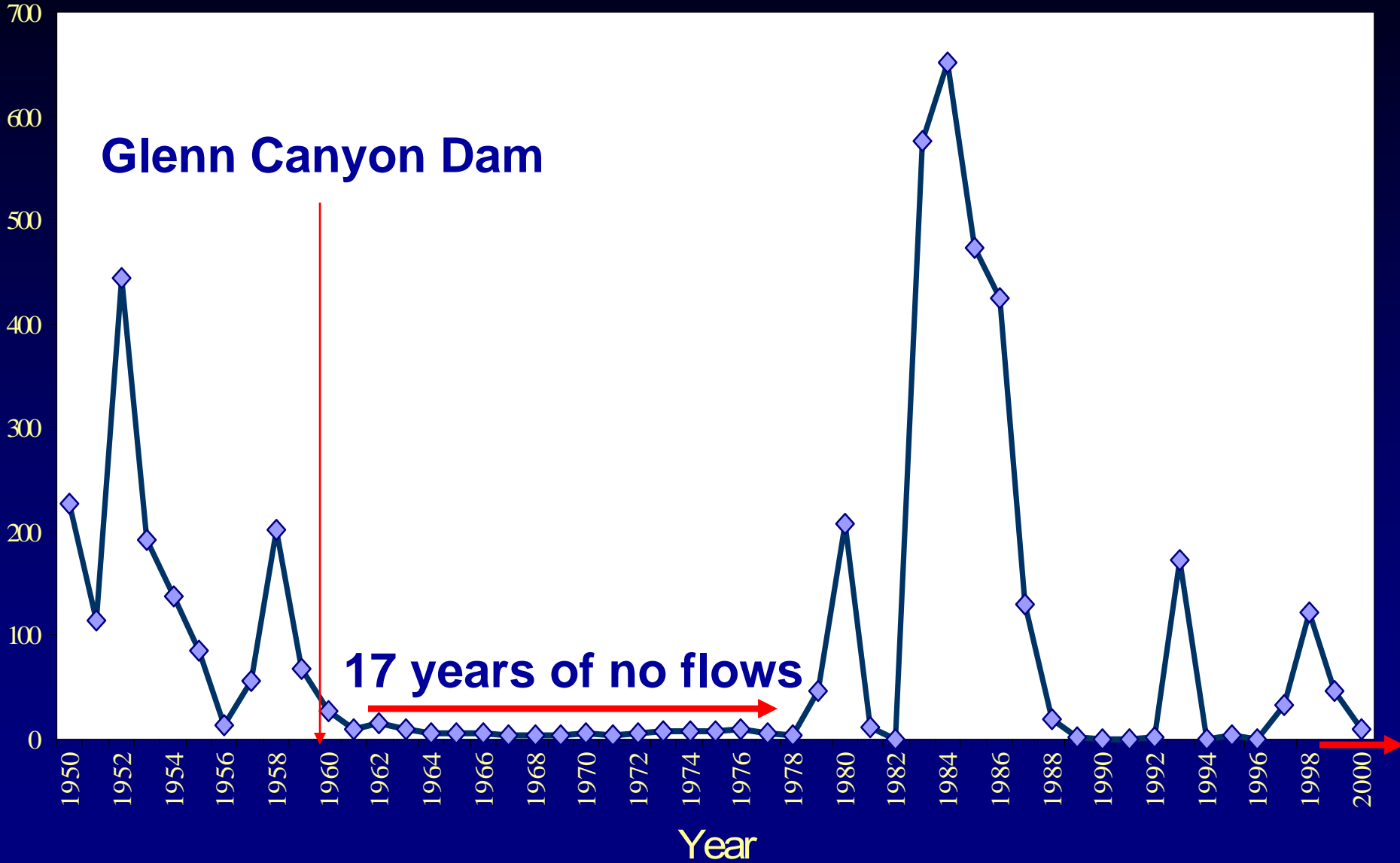
Presa Morelos

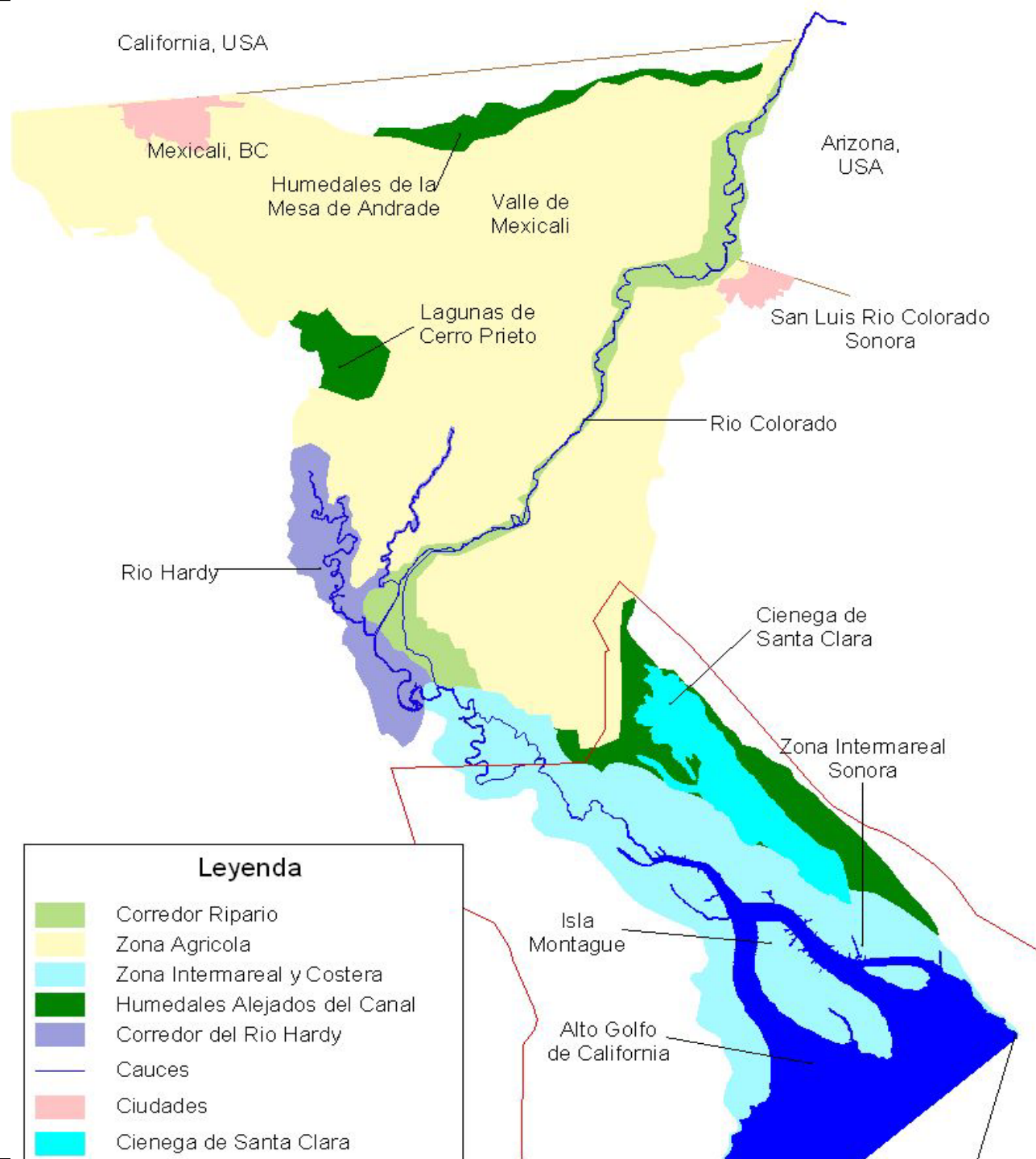
Yuma,  
Arizona

San Luis,  
Sonora



# Colorado River Flows to the Delta (Mx)





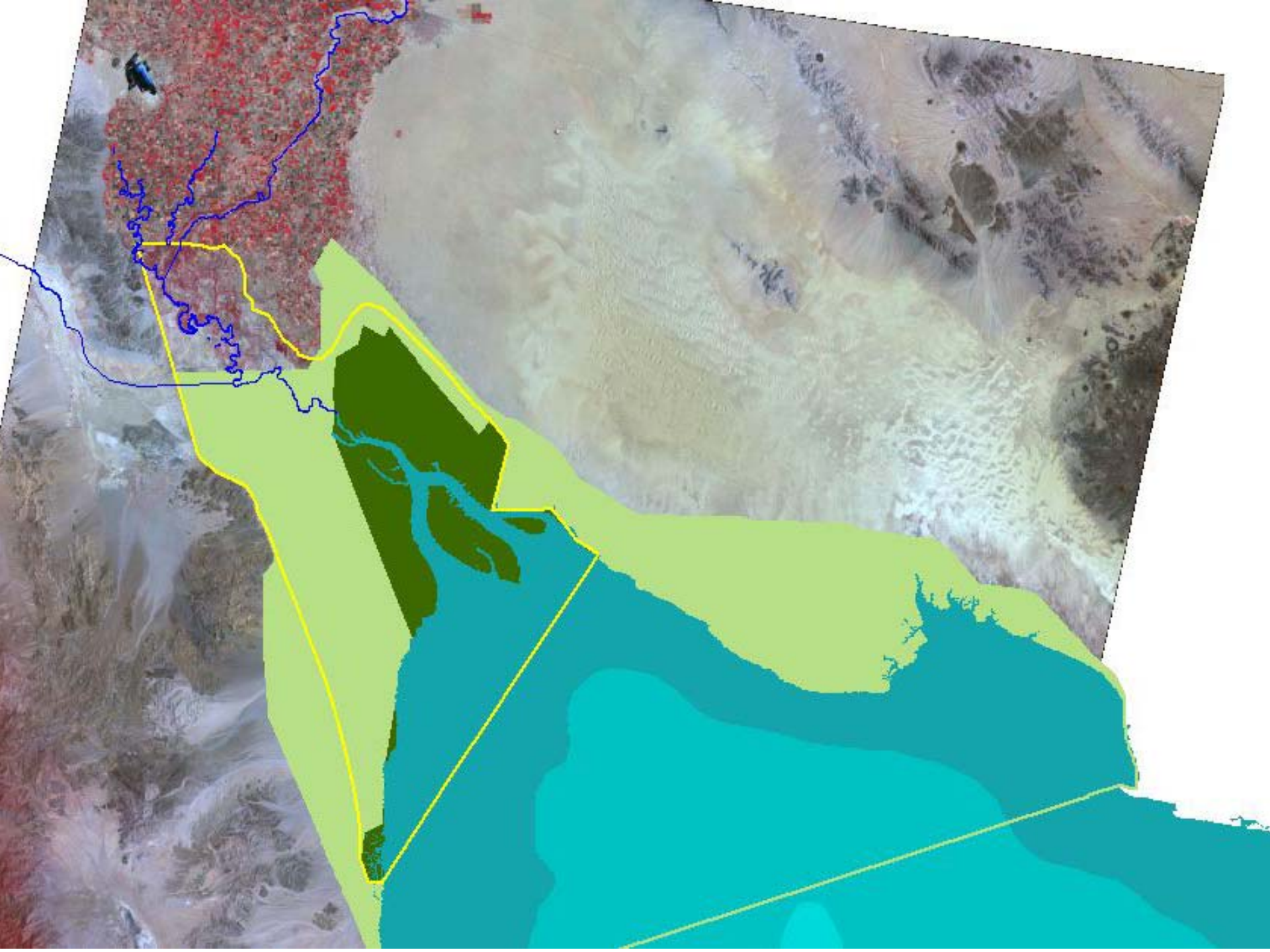




# Recognition of the Colorado River Delta

- Ramsar Site
- Biosphere Reserve
  - Federal Recognition in Mexico
  - UN Man and the Biosphere Program
- Western Hemisphere Shorebirds Reserve Network
- AICA / Important Bird Area
- CONABIO Priority Conservation Site
- Conservation Priority in the Gulf of California





# The Birds of the Colorado River Delta

A total of 368 species have been documented in the Colorado River Delta region (19 new records in the last 6 years)

350,000 wintering shorebirds

+50,000 wintering waterfowl

# The Birds of the Colorado River Delta

Two Endangered Species: California Black Rail  
Bald Eagle, and Southwestern Willow Flycatcher  
(Ex)

Six Threatened Species: Yuma Clapper Rail,  
Snowy Plover, Black Storm-Petrel

Sixteen species Under Special Protection: Least  
Tern, Large-billed Savannah Sparrow, Virginia  
Rail, Peregrine Falcon

# Changes in the Avifauna

Most changes on riparian dependant species, including those that require mature cottonwood-willow forest or mature mesquite forest

Extirpations of breeding species, but also of wintering species

Reduction on the abundance of wintering waterfowl

# Changes in the Avifauna

## 8 Extirpated species:

### Former Breeders

- Willow Flycatcher
- Summer Tanager
- Lucy's Warbler
- Yellow Warbler
- Gilded Flicker
- Fulvous-whistling Duck

### Wintering Species

- Sandhill Crane
- Roseate Spoonbill



# Different Projects

- Status of riparian birds and relationship with habitat features
- Landbird migration through the Colorado River Delta (El Doctor)
- Winter ecology of migrant landbirds
- Status and trends of marshbirds
- Status and trends of shorebirds

# Landbird Migration: Objectives

Assess the use of El Doctor by migratory landbirds

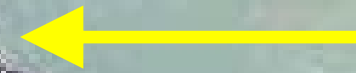
- Long-term monitoring site of bird migration
- Habitat conservation and restoration
- Summary of results and conservation implications





Ciénega de Santa Clara

El Doctor



Río Colorado

Isla Montague



# El Doctor Wetlands

- Maintained by freshwater springs along the Gran Desierto escarpment
- 350 ha of marshlands, mesquite and saltcedar areas
- Core zone of the Upper Gulf of California and Colorado River Delta Biosphere Reserve





# Methods

## Mist-netting

- 6 standard nets (12 m X 3.6 m, 36 mm mesh size)
- Operated 3 days in every 10-d period, 5 hours
- 30 net –hours per day, 90 net-hours per period
- From March 10 to June 10 (9 periods – 810 net hours per year)
- 4 years: 2002-2005

# Methods

## Bird Processing

- Banded with USGS aluminum bands
- Determine sex, age, fat levels, weight, molts, feather condition, breeding condition, skull ossification, and wing chord
- Wing morphology, tail length and bill measurements for *Empidonax* flycatchers



# Results

- Data to understand patterns of migration through the Sonoran coast
- Document the importance of stopover sites along the Colorado River delta
- Contribute to the understanding of migratory routes on western NA



# Results

- 4,704 birds captured and processed during all years
- 73 species
- Average capture rate: 1.74 birds per net-hour
- Maximum number of birds per day: 284 birds on May 8, 2003



# Results

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Year	Total Captures	Net hours	Birds PNH
2002	597	456.45	1.31
2003	1601	735.00	2.18
2004	1265	804.67	1.57
2005	1241	648.00	1.92

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Baltimore Oriole

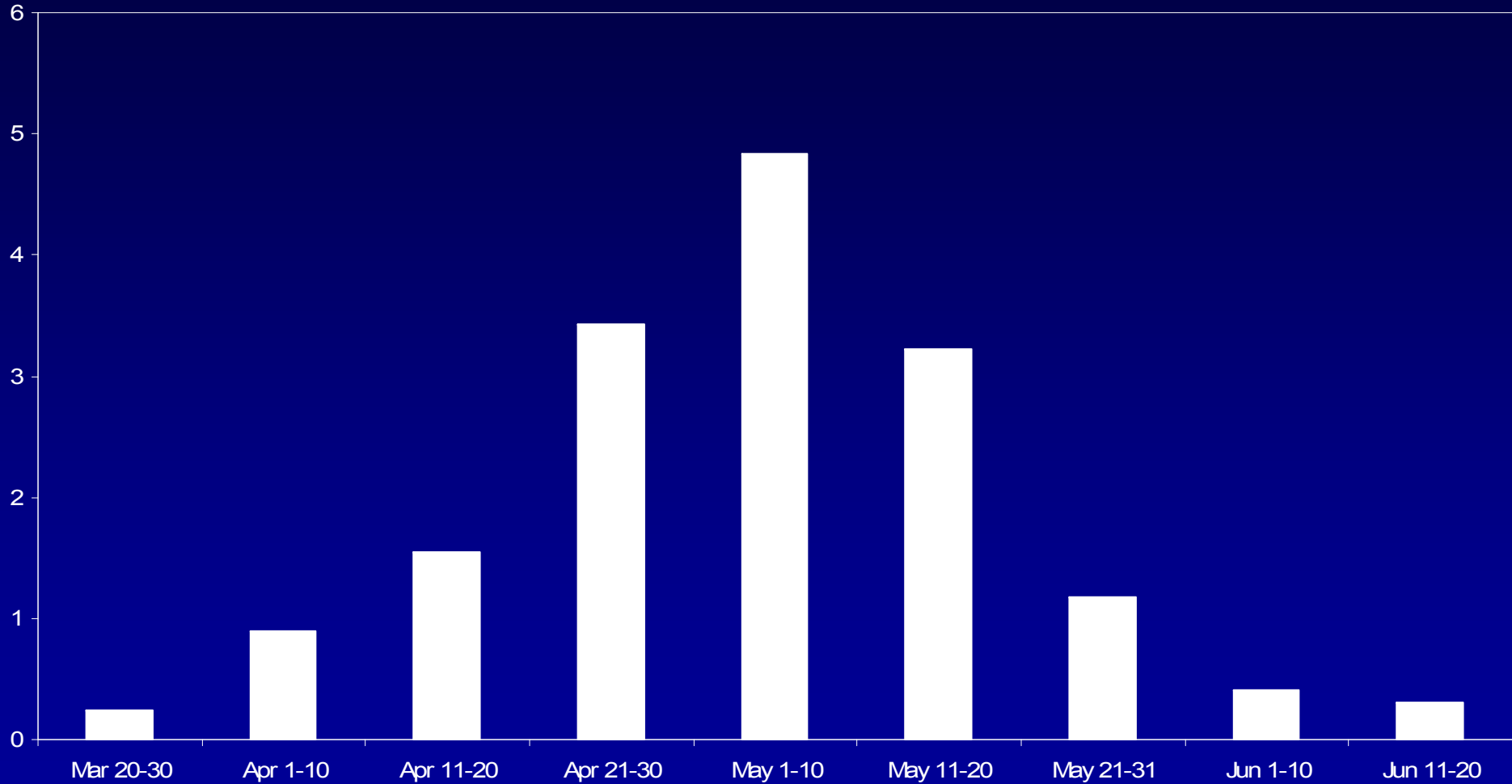


Ovenbird

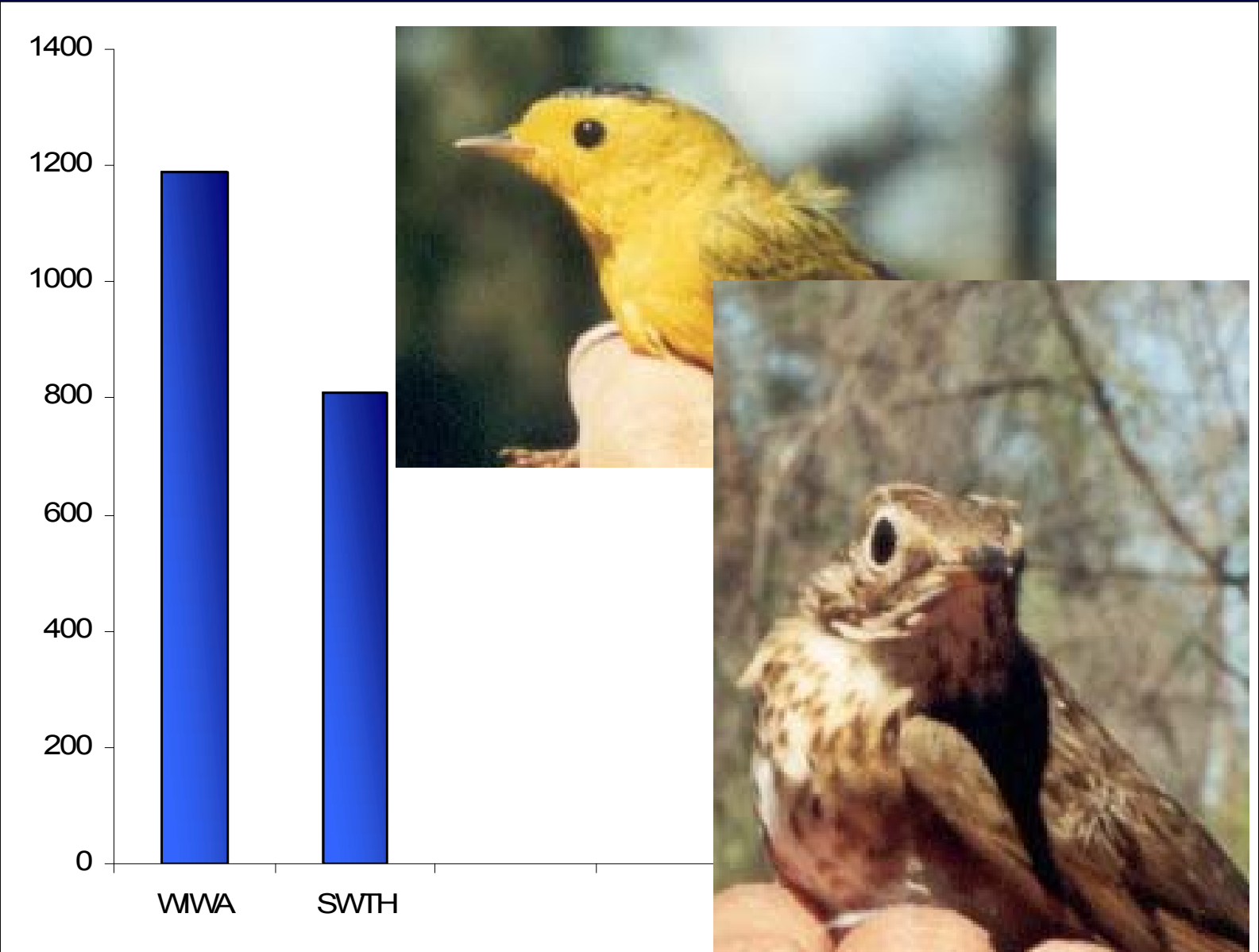




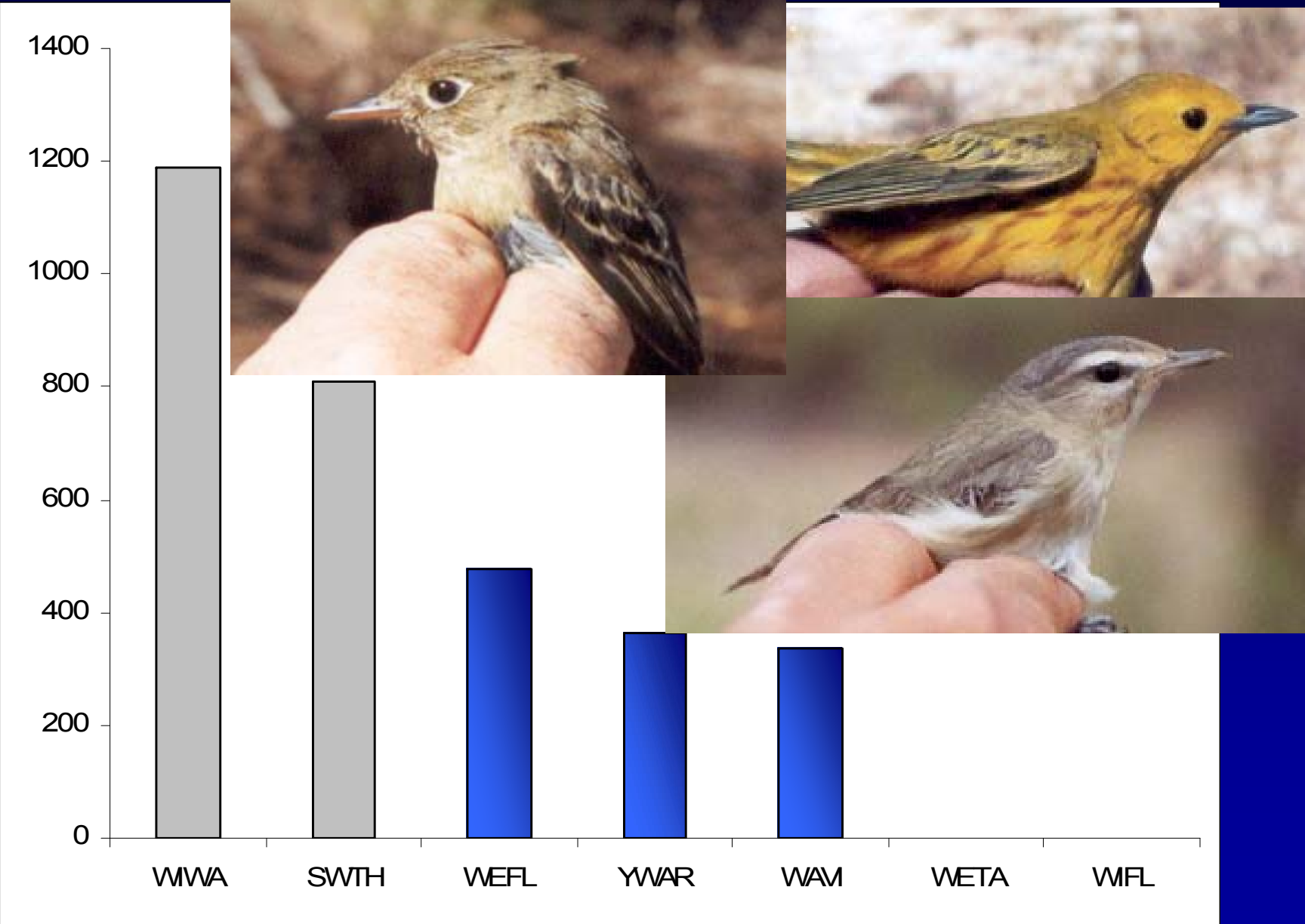
# Birds per net-hour at El Doctor



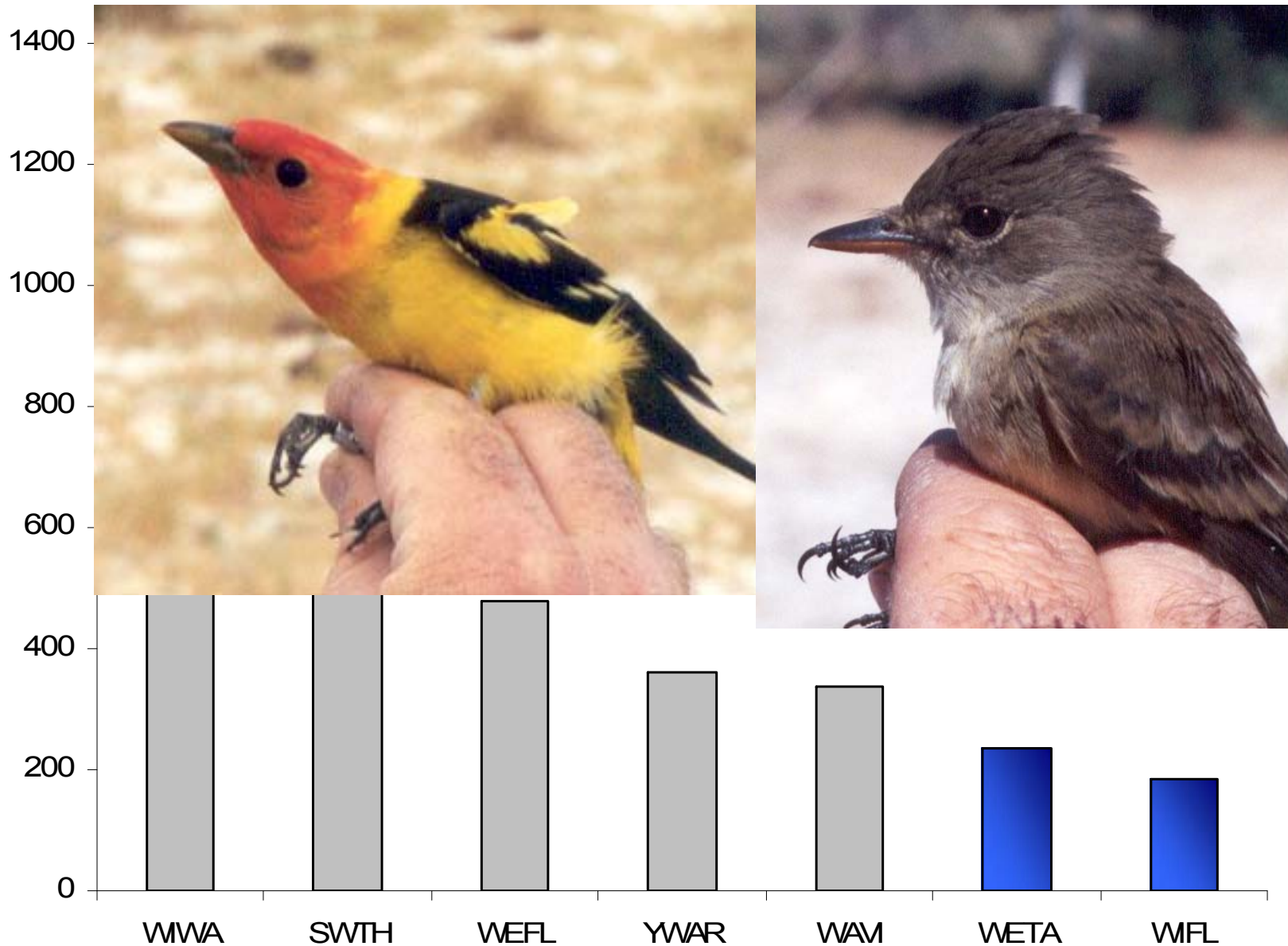
# Common migrants through El Doctor

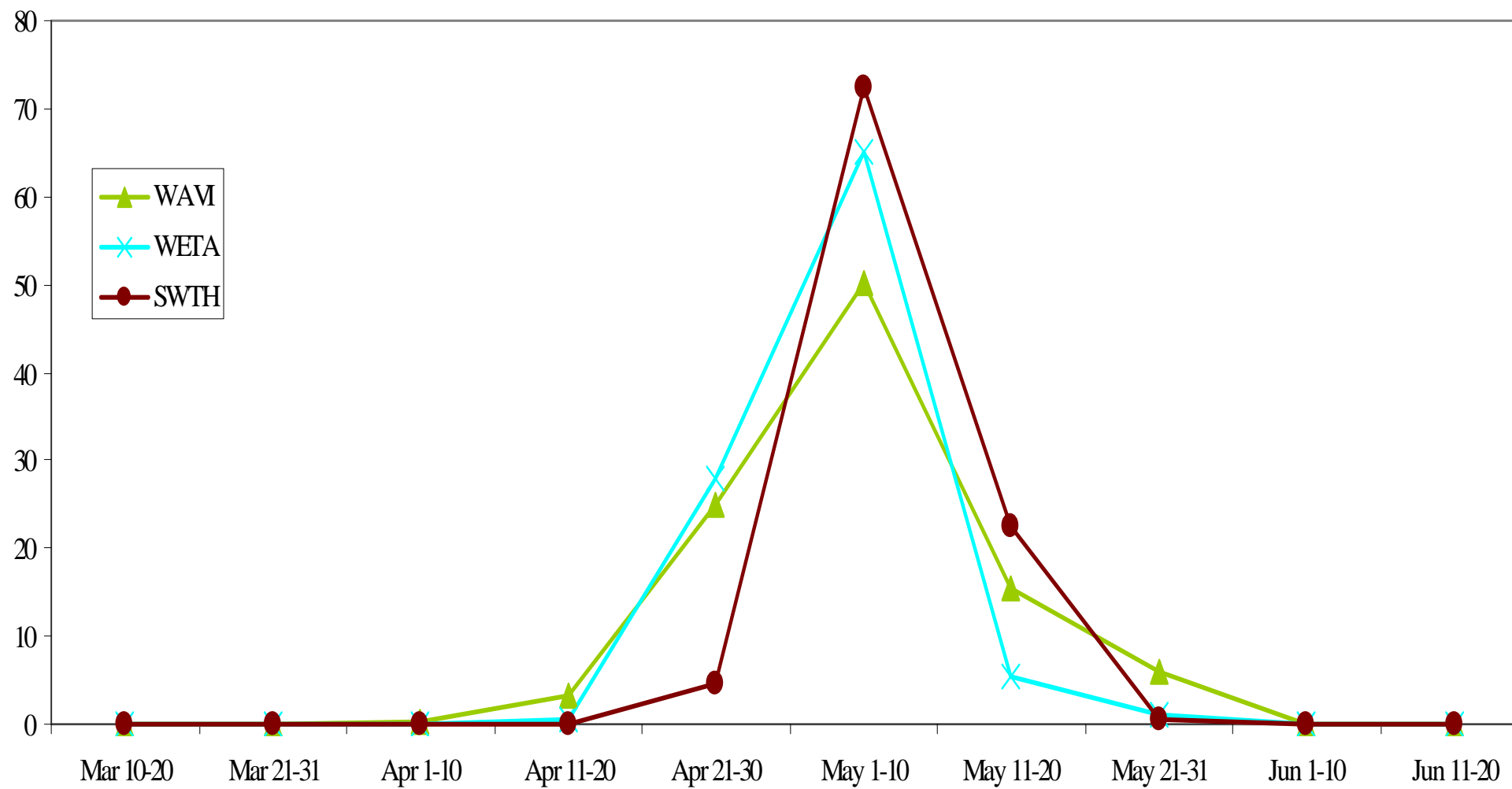


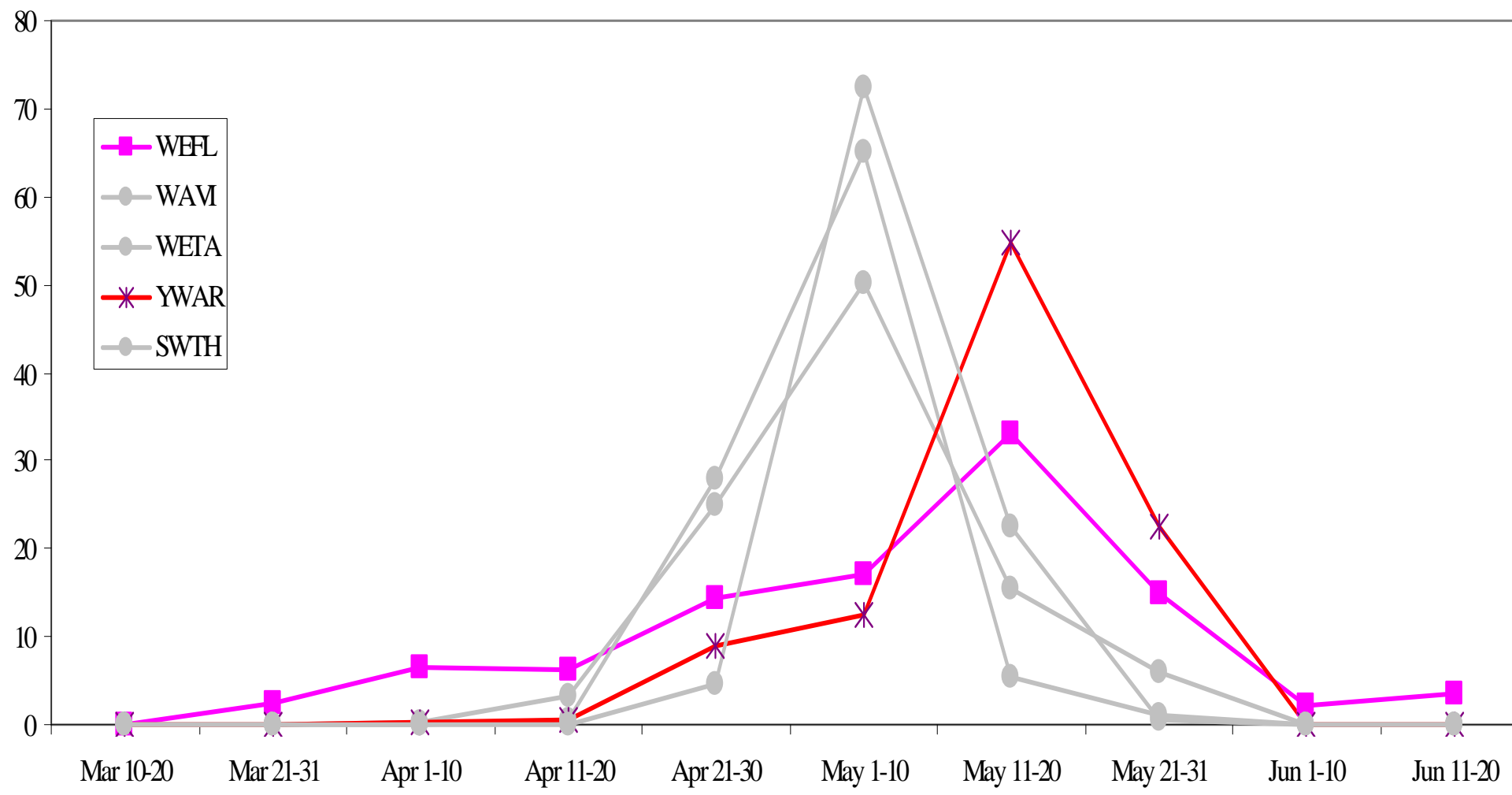
# Common migrants through El Doctor

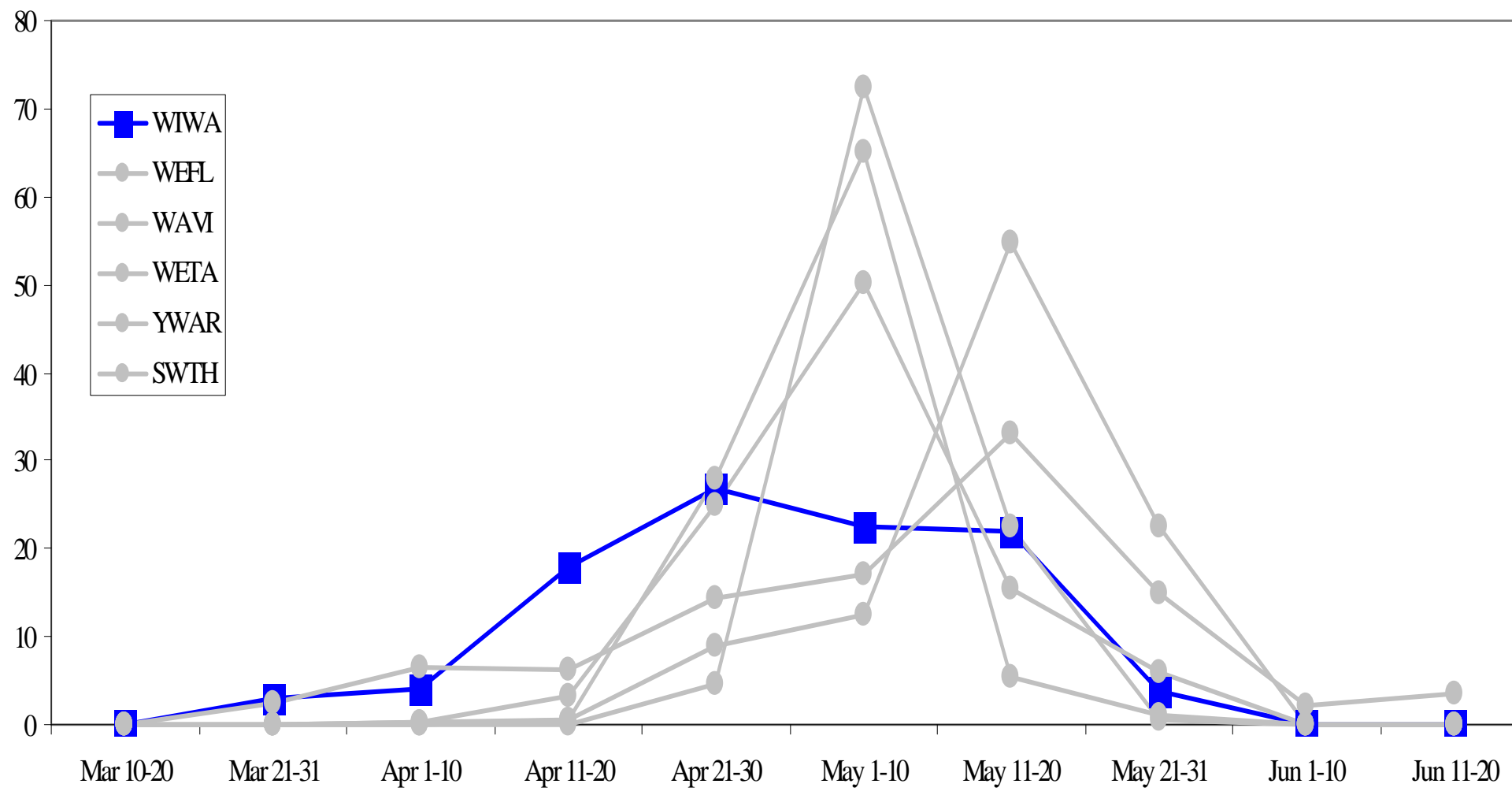


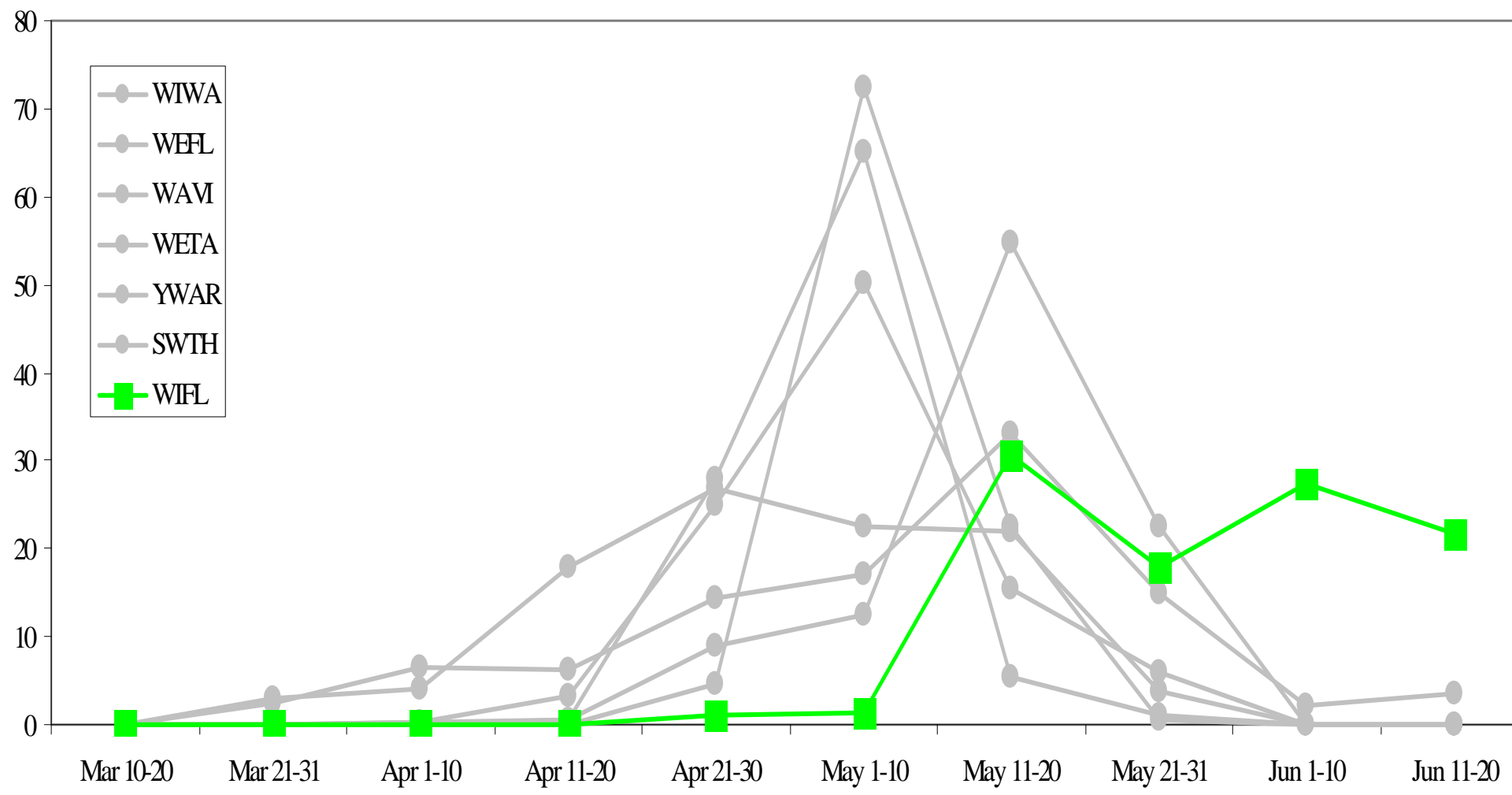
# Common migrants through El Doctor













# Recaptures

- Only 13% of recaptures

Of those:

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Recapture Period	Percent of Recaptures
0 d	65%
1 d	16%
2 d	4%
3 d	5%
> 3 d	10%

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# Fat levels

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Fat Level	Fat % in Furculum	% of Birds	Accumulative Percentile
0	0	16.10	16.10
1	1% - 5%	38.53	54.62
2	5% - 30%	24.83	79.45
3	30% - 60%	14.21	93.66
4	60% - 100%	5.82	99.49
5	>100%	0.51	100.00
6	>>100%	0.00	100.00

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# Fat levels

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Species	Fat = 0	Fat < 5%	Fat < 30%
SWTH	8.21	42.31	81.34
WEFL	23.89	60.32	79.14
WIWA	16.25	56.45	75.00
<b>WIFL</b>	<b>25.34</b>	<b>81.81</b>	<b>95.45</b>
WETA	5.87	38.23	76.47
YWAR	20.68	63.11	79.56
WAVI	12.44	40.12	69.23
All	16.10	54.62	79.46

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# El Doctor: stopover site

- Birds arrive with low reserves: probably after a long night flight
- Birds stay at El Doctor for a short period of time, and keep migrating north
- El Doctor might play a critical role as a stopover site, providing resting sites, fresh water, and food
- Further research is required to determine patterns of migration along the coast of Sonora and the activities of migrant birds at El Doctor

# El Doctor: threats and conservation opportunities



# EI Doctor: conservation

- Biosphere Reserve: but impact of cattle grazing
- Depletion of groundwater table by pumping in the region
- Low recruitment of native trees

Conservation measures in the area include:

- Exclusion of cattle by fencing
- Reforestation: mesquite
- Establishment of Conservation Easements with landowners to secure the long-term conservation of the area

# Next steps...

- Long-term banding at El Doctor: use captures per year as an abundance index to monitor population trends
- Monitor migration across habitat types in the Colorado River delta region: saltcedar/mesquite/cottonwood-willow
- Establish migration monitoring sites along the Sonoran coast
- Conservation and restoration activities at El Doctor
- Develop and implement conservation strategies for key stopover sites across the Sonoran Desert

# Winter Ecology: Objectives

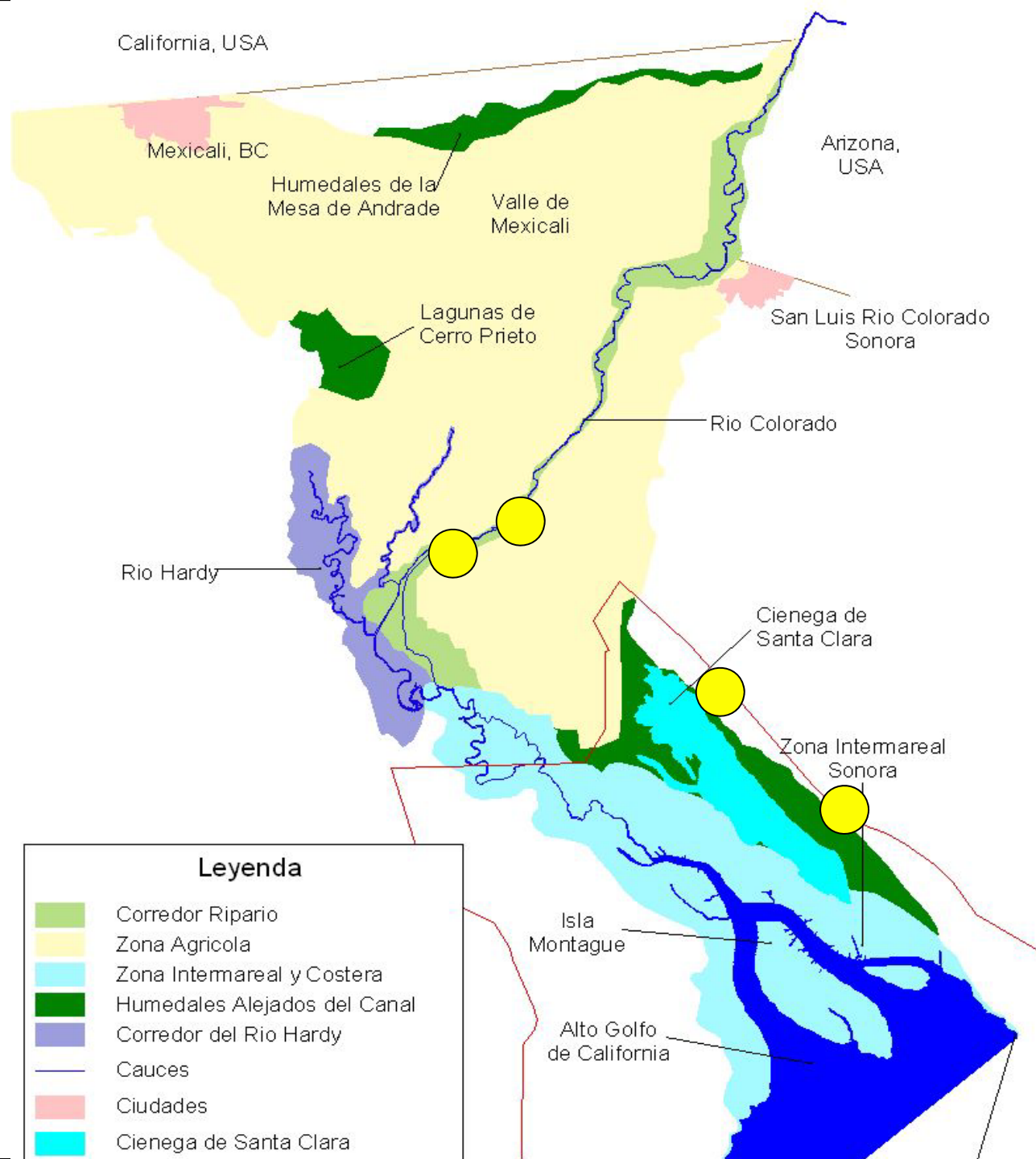
- Evaluate habitat relationships and monitor trends of wintering songbirds in the Colorado River delta, Mexico, conducting variable distance point counts.
- Estimate winter survival and population demographics following the MoSI protocol.





# Bird banding

- 3 years, 2003-2004, 2004-2005, 2005-2006
- 5 monthly pulses, November through March
- 4 sites, 2 on mesquite/marsh habitat, 2 on riparian habitat (cottonwood - willow).
- 16 (12m) nets (36 mm mesh) on 20 ha plot
- Operated 15 min before sunrise until 17:00 hr.
- Conducted searches for color-banded individuals



# Banded Birds

- 21 species of wintering landbirds have been banded in the Colorado River delta

Species	% captures
<i>Regulus calendula</i> - RCKI	14.9
<i>Vermivora celata</i> - OCWA	13.9
<i>Dendroica coronata</i> - YRWA	13.2
<i>Melospiza lincolnii</i> - LISP	7.7

# Wintering Landbirds

Based on the results:

At least 21 riparian songbirds are winter residents in the Colorado River Delta region

However, birds are not 'residents' and do not establish territories in a particular riparian patch (10-20 ha), and move through the region during winter

- Low recapture estimates/low p of recap history
- High estimates of proportion of transients

# Riparian Birds: Objectives

- Patterns of bird densities and species richness
- Relationships with habitat and land cover features



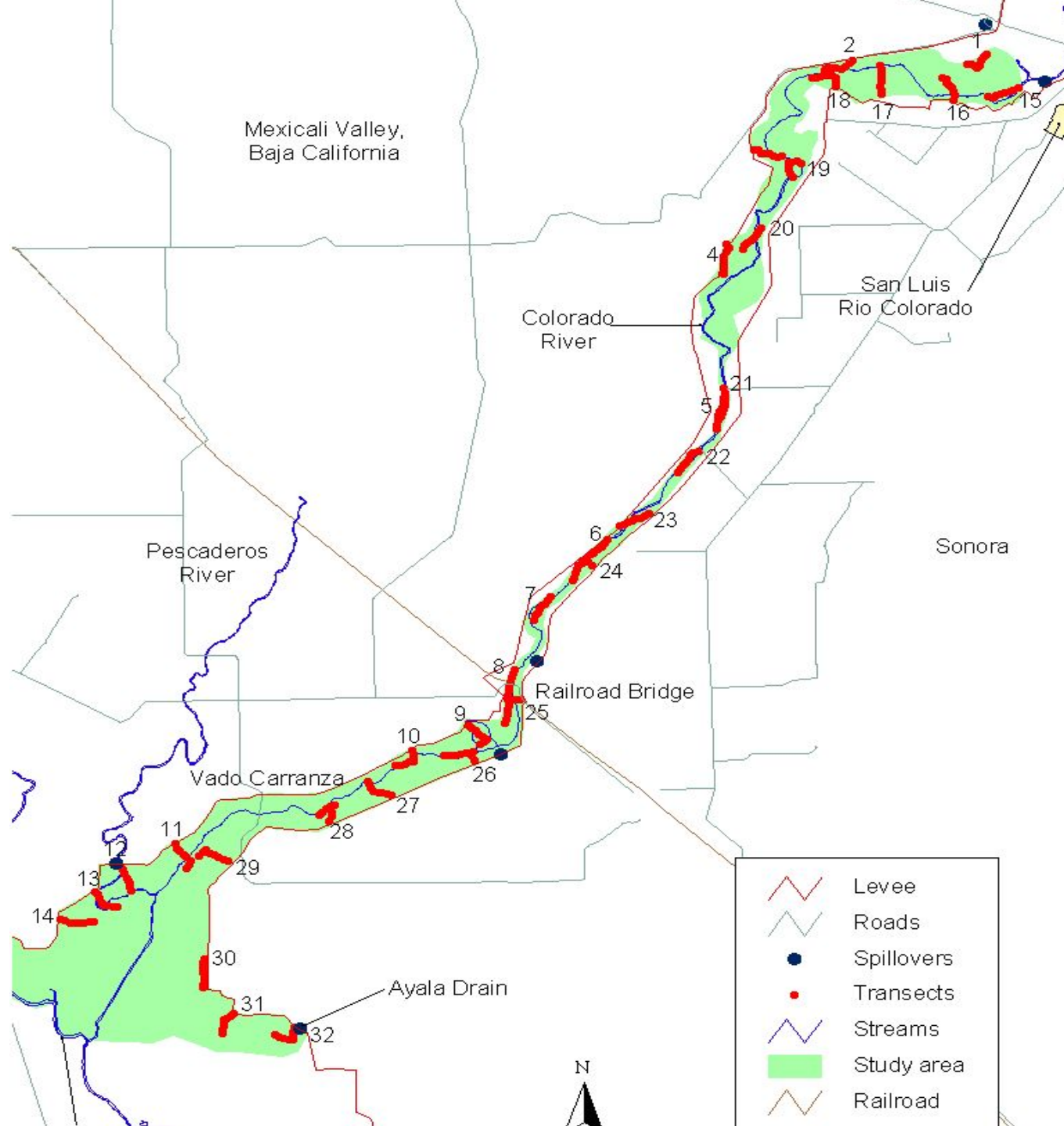
# Objectives

- Habitat value of cottonwood-willow versus saltcedar sites
- Identify restoration guidelines

# Patterns of Richness and Densities

- 30 transects along the Colorado River floodplain, 240 variable distance point counts (5 min)
- Measurement of habitat features
- Monthly surveys, May 2002 – July 2003









## Second phase: Habitat value of Native vs Saltcedar sites

- Bird and habitat surveys at 175 randomly selected plots
- Visited 3 times during the breeding season (May-July), 2003 and 2004

NW



**SW**



**SD**





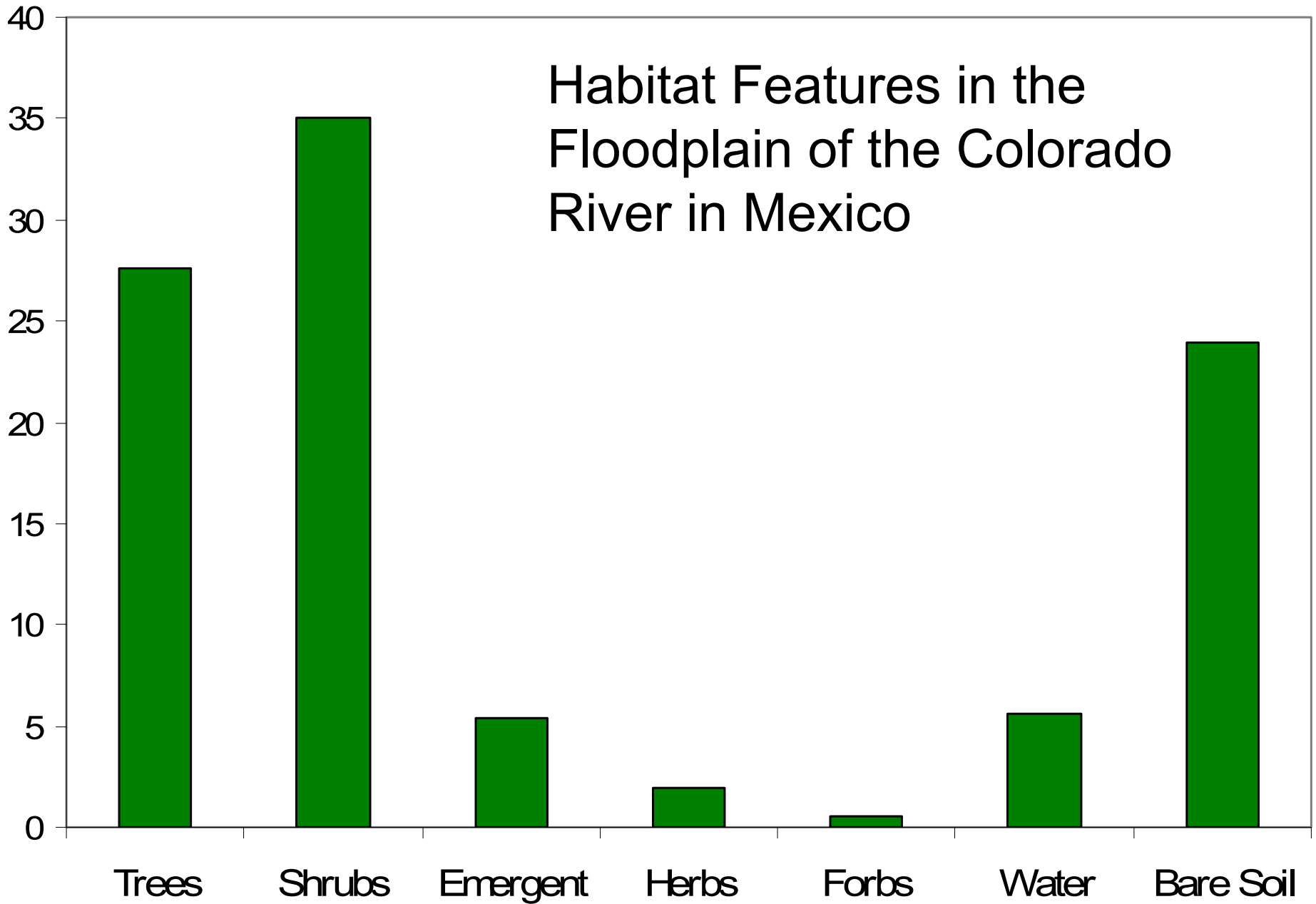
**ND**



# Value of Native vs Saltcedar

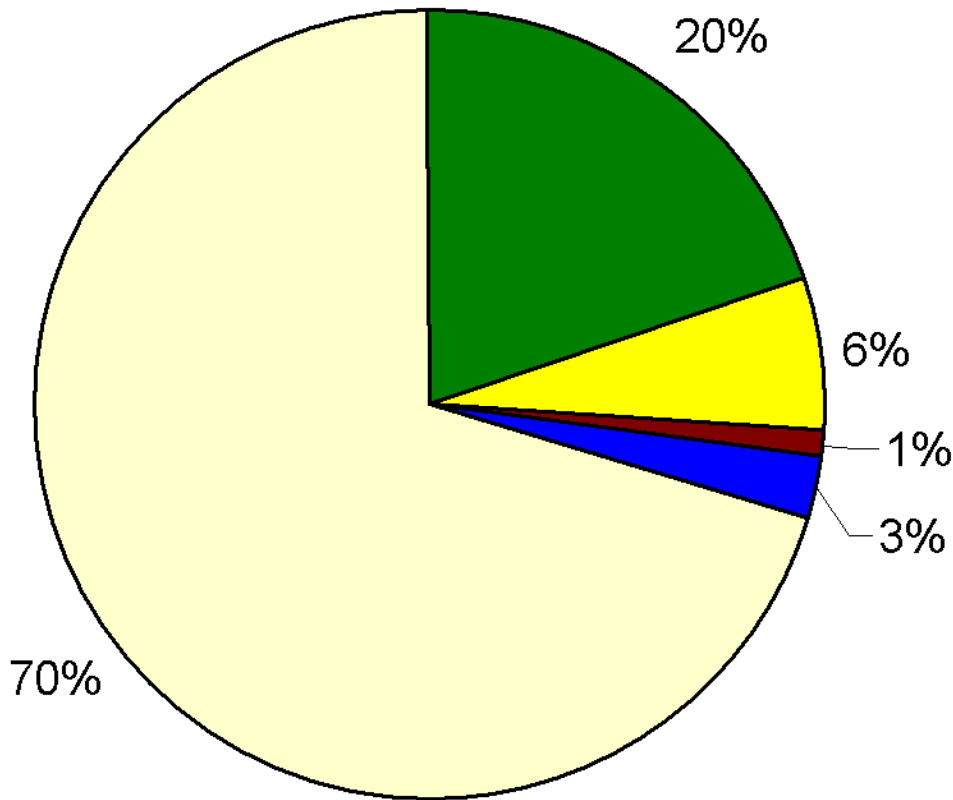
- All sites with >50% vegetation cover
- Wet sites with >5% surface water (<30%)
- Dry sites >400 m away from surface water
- Native sites with >15% cover of cottonwoods and/or willows
- Saltcedar sites with >30% cover of saltcedar and no willows, cottonwoods, and/or mesquite

# Habitat Features in the Floodplain of the Colorado River in Mexico





# Percent cover by species within the Tree stratum in the Floodplain of the Colorado River in Mexico



Willow

Cottonwood

Honey Mesquite

Screwbean Mesquite

Saltcedar

# Floodplain of the Colorado River

A total of 109,287 bird records; 186 species

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Summary of Bird Data	Per Point
Records	29.21 ( $\pm$ 1.20)
Number of Species	8.58 ( $\pm$ 0.16)
Density per Ha	47.67 ( $\pm$ 7.01)

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# The Floodplain of the Colorado River

## Most common birds

- Mourning Dove
- Brown-headed Cowbird
- Red-winged Blackbird

41% of all records



# Current Status of Birds in the Delta

64 species were common in the floodplain (>10 records per visit):

- Abert's Towhee
- Song Sparrow
- Blue Grosbeak
- Crissal Thrasher
- Verdin
- Black-tailed Gnatcatcher
- Gila Woodpecker
- Ladder-backed Woodpecker
- Ash-throated Flycatcher
- Common Yellowthroat



# Current Status of Birds in the Delta

Species that declined, but are now common:

- Vermillion Flycatcher
- Clapper Rail
- Least Bittern
- Cinnamon Teal
- Yellow Breasted Chat

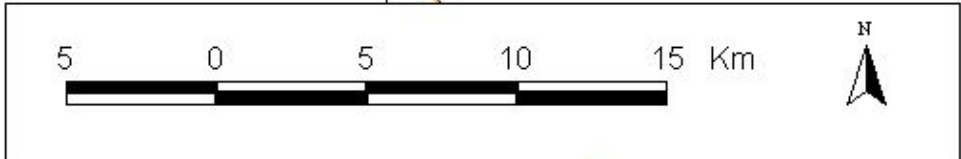
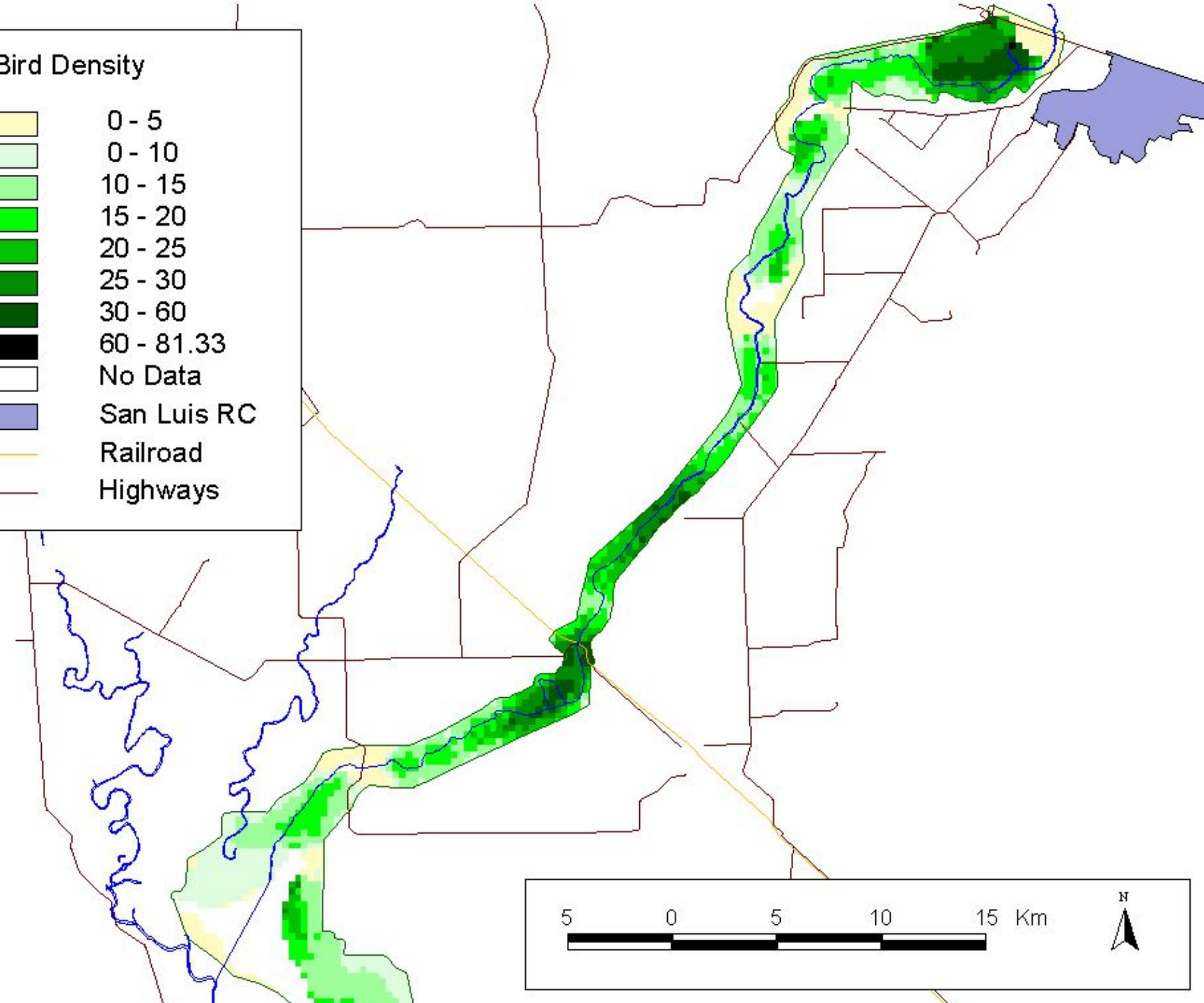
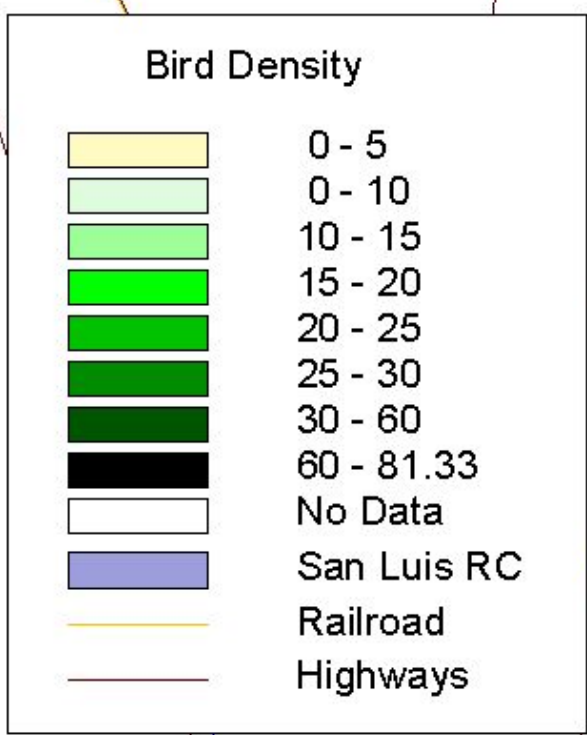


# Current Status of Birds in the Delta

Species that declined (extirpated), but are recuperating:

- Yellow-billed Cuckoo
- Lesser Goldfinch
- Bell's Vireo
- Osprey





# Which habitat features explain avian richness?

- Cover (ha) of surface water, regardless of vegetation type

Adjusted  $r^2 = 0.45$ ,  $p < 0.001$ ,  $F_{1,28} = 24.83$

Effect	Coeff	SE	Std C	Tol	$t$	$P$
Constant	20.74	1.34	0	.	15.49	< 0.001
Water	0.84	0.17	0.67	1.00	4.98	< 0.001



# Which habitat features explain avian richness during the breeding season?

- Surface water
- Cottonwoods

Adjusted  $r^2 = 0.53$ ,  $p < 0.001$ ,  $F_{2,27} = 17.40$

Effect	Coeff	SE	Std C	Tol	$t$	$P$
Constant	19.89	1.07	0	.	18.55	< 0.001
Water	0.63	0.12	0.65	0.99	5.09	< 0.001
Cottonwoods	0.32	0.13	0.32	0.99	2.49	0.02

# Which habitat features explain avian densities?

- Surface water
- Screwbean mesquites

Adjusted  $r^2 = 0.28$ ,  $p = 0.005$ ,  $F_{2,27} = 6.63$

Effect	Coeff	SE	Std C	Tol	$t$	$P$
Constant	22.50	9.38	0	.	2.40	0.02
Water	2.74	1.07	0.41	0.98	2.57	0.02
Sc. Mesquite	4.21	1.45	0.46	0.98	2.90	0.01

# Which habitat features explain avian densities during the breeding season?

- Surface water
- Willows

Adjusted  $r^2 = 0.31$ ,  $p = 0.003$ ,  $F_{2,27} = 7.49$

Effect	Coeff	SE	Std C	Tol	$t$	$P$
Constant	9.75	7.50	0	.	1.30	0.2
Water	1.84	0.73	0.39	1.00	2.54	0.02
Willows	1.83	0.61	0.47	1.00	3.01	0.01



## Corroboration of habitat characteristics in the 4 habitat groups: NW, ND, SW, SD

No difference in vegetation cover

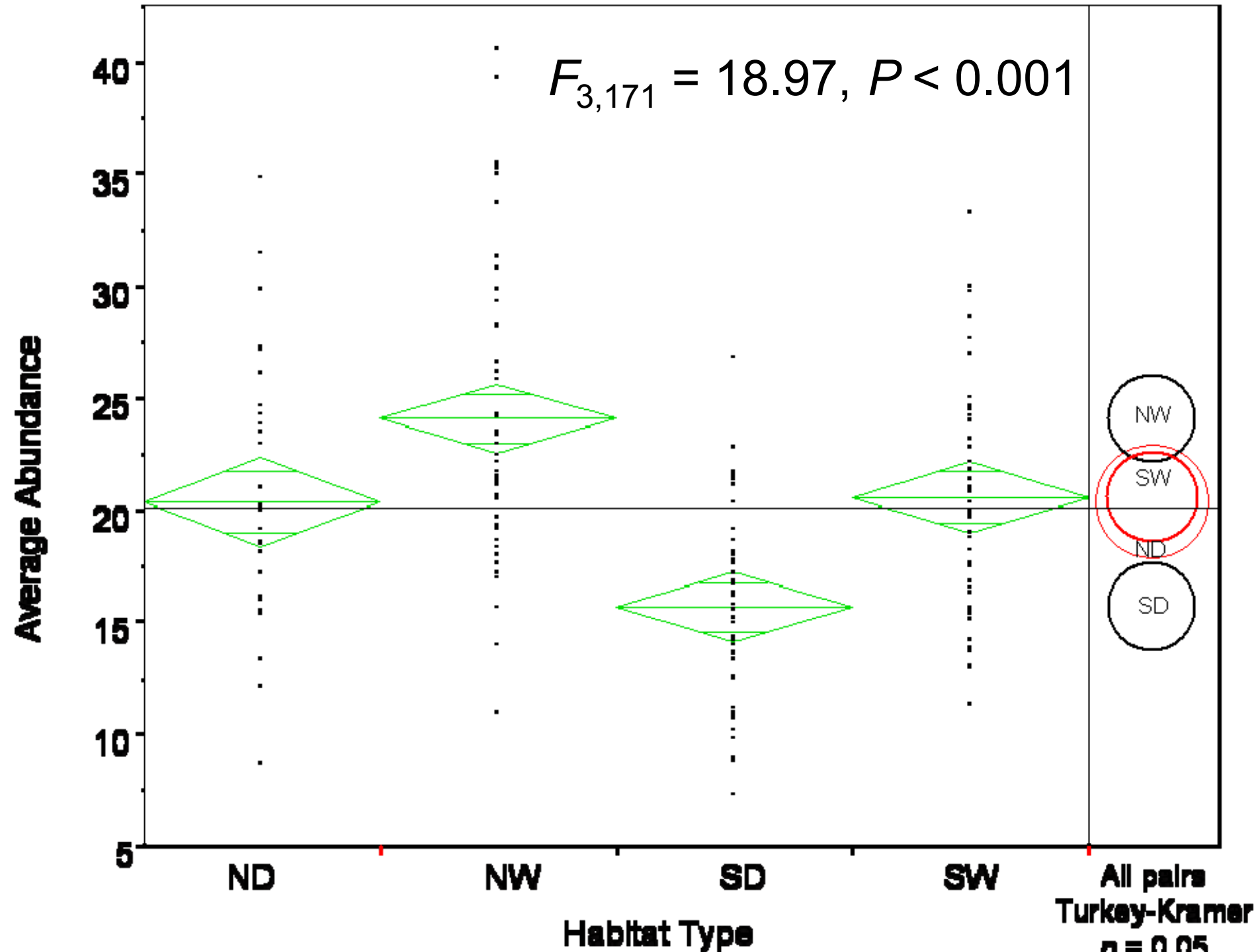
74% ( $\pm 1.03$ );  $F_{3,171} = 0.27$ ,  $P = 0.88$

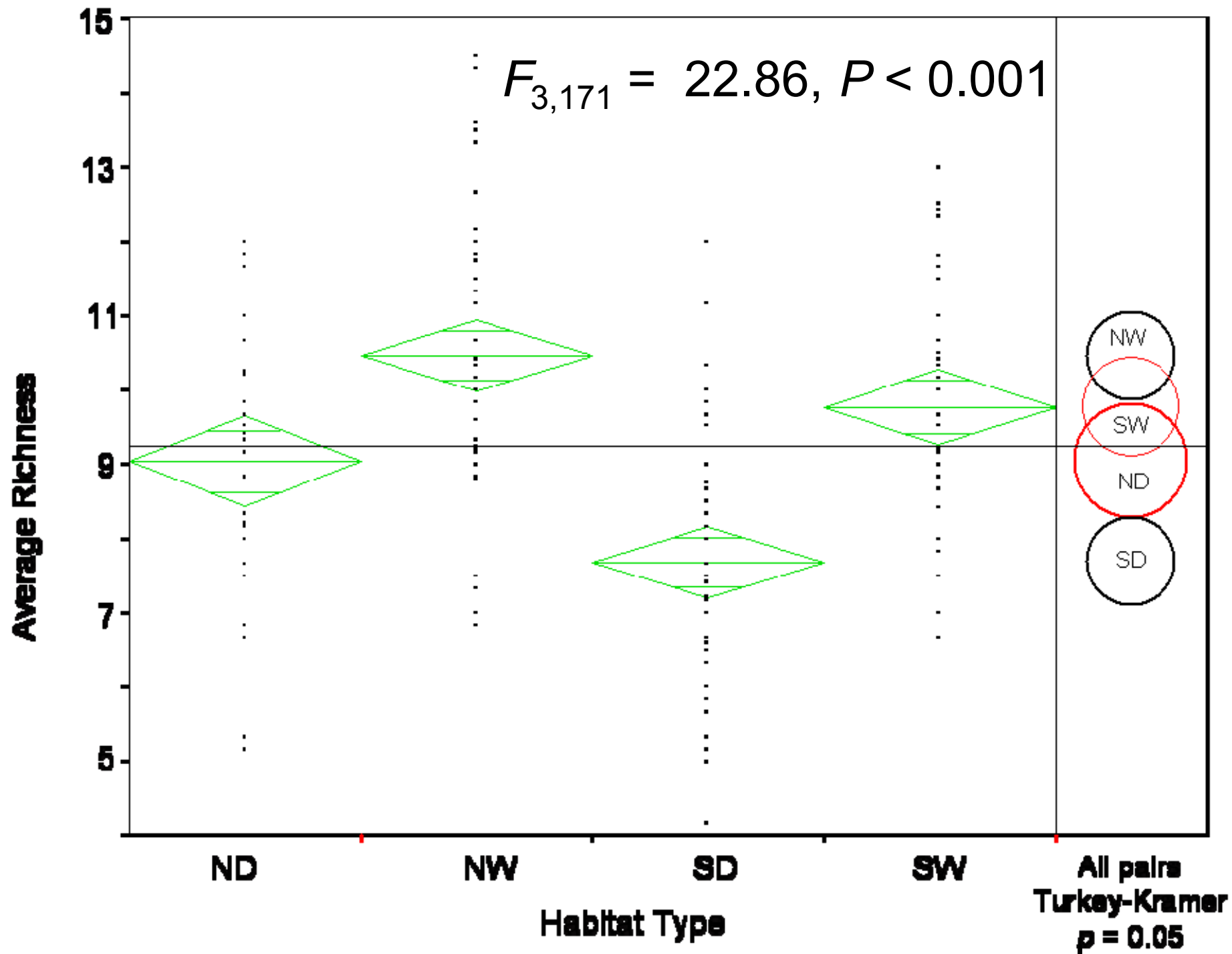
No difference in cover by trees

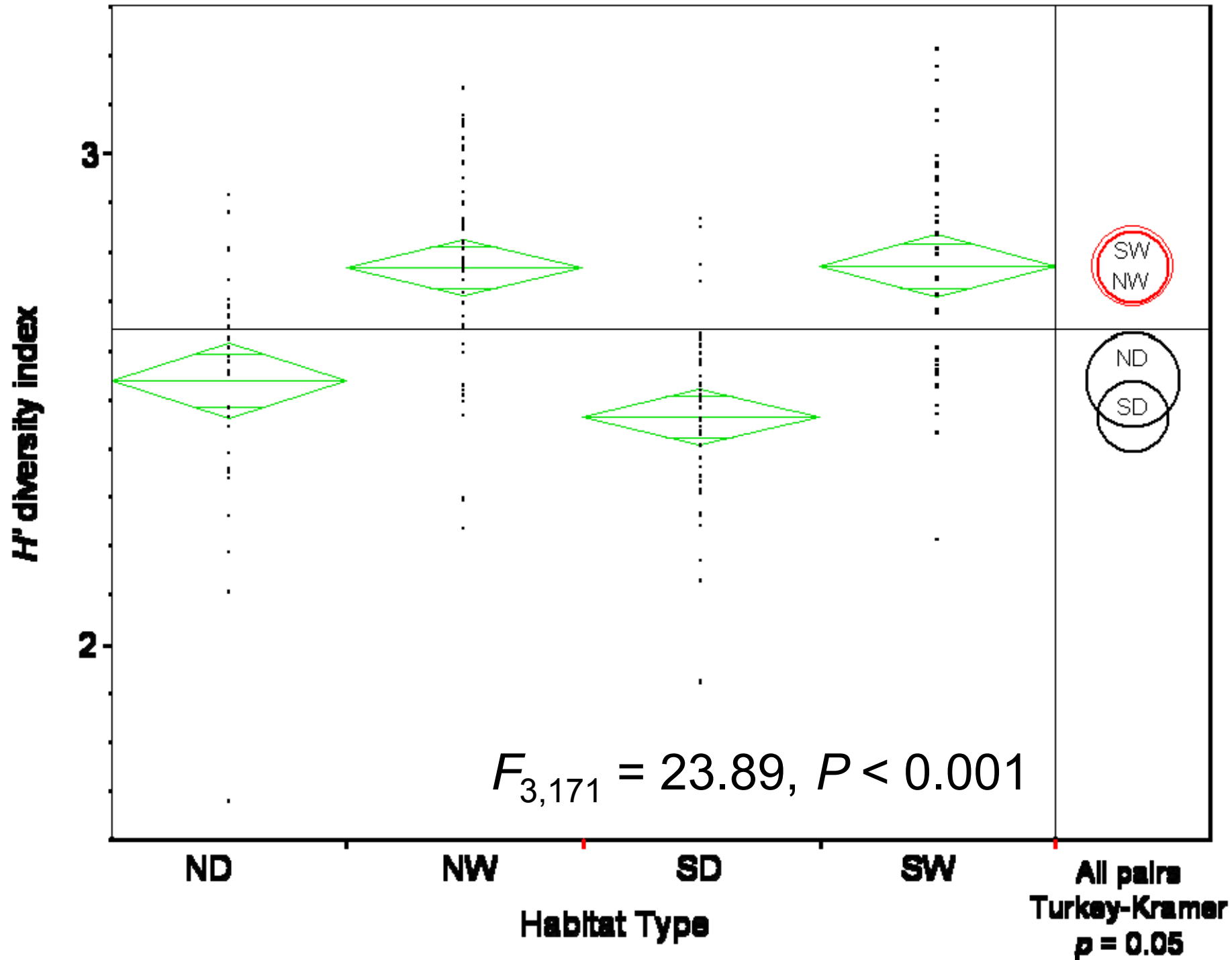
32% ( $\pm 1.32$ );  $F_{3,171} = 1.65$ ,  $P = 0.18$

No difference in water cover at the wet sites

10% ( $\pm 0.72$ ); Turkey-Kramer  $P = 0.36$









# Birds of the Colorado River in Mexico

- The presence of water determines ecological value
- Diversity: more influenced by surface water
- Abundance:
  - Wet sites > Dry sites
  - Saltcedar Wet  $\approx$  Native Dry

# Birds of the Colorado River in Mexico

- Restoration ≠ eradication of saltcedar
- Enhance riparian bird habitats: increase surface water
- Additional effects: regeneration of native trees, even in the presence of saltcedar

An aerial photograph of a river delta at sunset. The sun is low on the horizon, creating a bright, golden glow that illuminates the clouds and the water. The river channels are visible, branching out from the top of the frame towards the bottom. The water reflects the light from the sun, creating a shimmering effect. The sky is a mix of blue and orange, with scattered white clouds.

## Initiative for the Restoration of the Colorado River Delta

- **Legal Protection of Natural Areas**
- **Participative Management Plan**
- **WATER**



# Conservation Measures

- Secure water sources for the Colorado River: voluntary, market-based process
- Establish legal strategies and community-based initiatives for the protection of the floodplain
- Restore cottonwood-willow and mesquite areas in the floodplain

