Tidal Marsh Birds of Suisun Marsh: Population Status, Habitat Associations, and Patterns of Reproductive Success

Nadav Nur, Hildie Spautz, Diana Stralberg, and Nils Warnock

Historical Background

• Tidal Marsh was once the predominant habitat in San Francisco Estuary.

• 80% of this habitat has been lost over past 150 yrs (conversion to agriculture, to commercial salt ponds, development)

• What's left is altered compared to original habitat:
- habitat fragmentation,
- man-made structures,
- levees, dikes, channelization,
- changes in salinity
- subject to invasive species, contaminants, and other threats

Background

- Yet many bird species have evolved specifically to utilize tidal marsh habitat (endemic species or subspecies).
- This conservation concern led to the initiation of

  PRBO's Tidal Marsh Project in 1996 in marshes throughout the San Francisco Estuary
- Today's talk summarizes results from this ongoing project –
- Now encompasses
  - 60 study marshes, 500 survey locations, 8 years of intensive study

Tidal Marsh Song Sparrow

Salt Marsh Common Yellowthroat

Objectives of PRBO's Tidal Marsh Project

1. Determine population status, trend of each species or subspecies

2. Identify important habitat features and vegetation characteristics
that birds respond to or require:

--local scale (a bird's territory or home range)

--broader, regional scale

That is, evaluate importance of landscape: adjacent land use,

habitat fragmentation

3. Understand population processes supporting viable populations:

Focus on: Level of reproductive success, and how variable is it.

Information on other demographic parameters.

Adult survival, Juvenile survival, Dispersal

Synthesize into a population dynamic model to determine viability

Objectives, cont

4. Assess Tidal Marsh habitat and Guide Restoration *using birds as indicators*

- What characterizes "healthy" functioning marsh habitat, from the perspective of birds?

  What are important habitat features and landscape characteristics?

- How can this information be used to guide present and future Tidal Marsh restoration?

- What should we be monitoring to evaluate success?

- How does bird use of a marsh change over time in a successful marsh restoration?

Outline of Talk

•Population Status

•Local Habitat Features and Landscape Characteristics Influencing Abundance of Tidal Marsh species

What Do Birds Need? What makes for a Good Marsh?

•Reproductive Success: Patterns of variation

Ongoing studies:

•Studies of Restoring Marshes:

  •Comparisons with Mature Tidal Marsh

  •Year-round studies of all birds (shorebirds, waterfowl, wading birds, rails, raptors, songbirds)

Photo: Peter LaTourrette

Four Principal Study Species

Song Sparrow, *Melospiza melodia*

3 distinctive subspecies, confined to salt marsh habitat of San Francisco Estuary

- Alameda Song Sparrow
- Samuel's Song Sparrow
- Suisun Song Sparrow, *M. m. maxillaris*

All are California "Species of Special Concern"

Common Yellowthroat
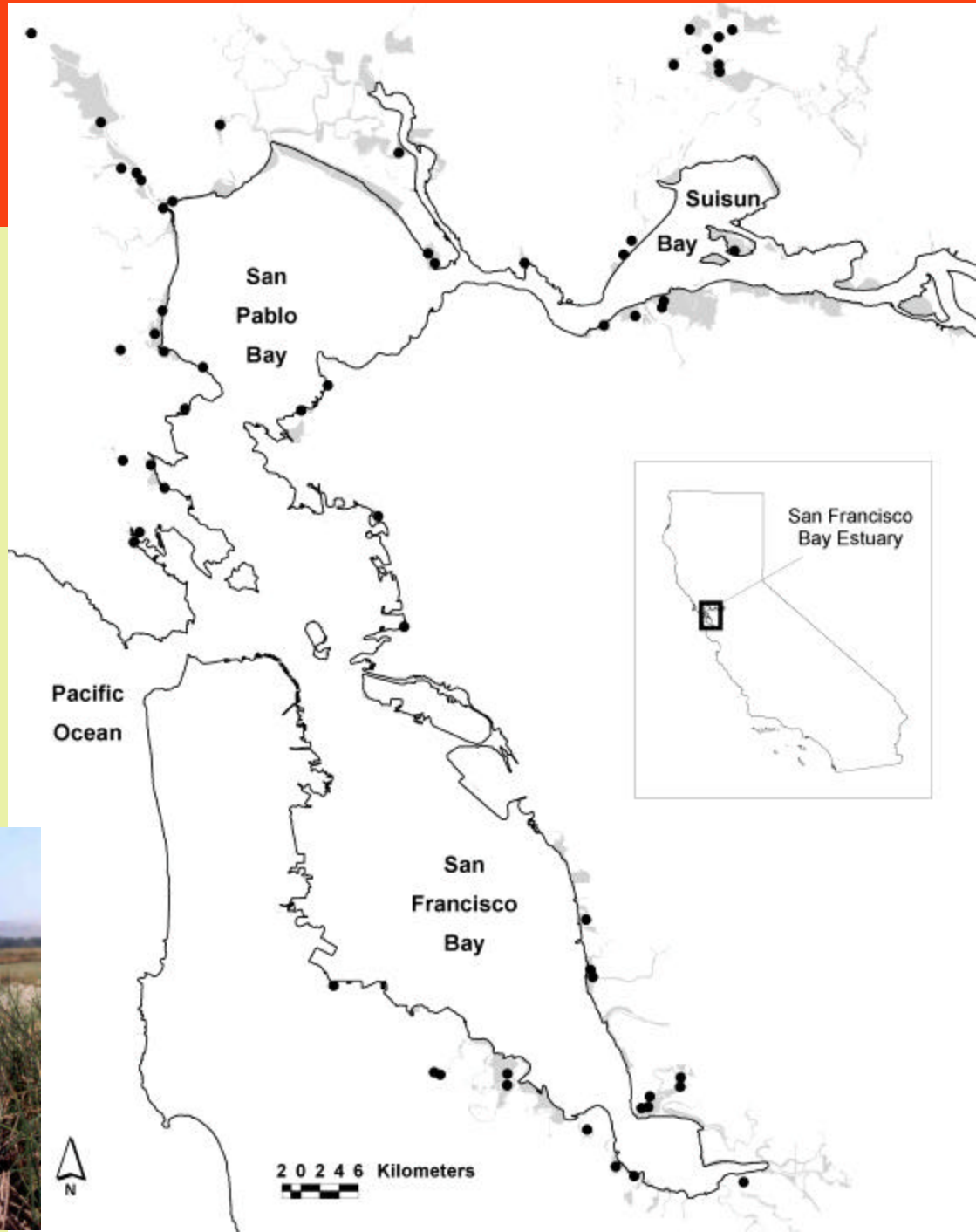
Marsh Wren

Black Rail

Study Sites

Methods:

Point counts conducted during during breeding season (March to May) to assess relative and absolute abundance of birds, by species.

Up to 15 points per marsh, 200 m apart, each point surveyed twice per year.

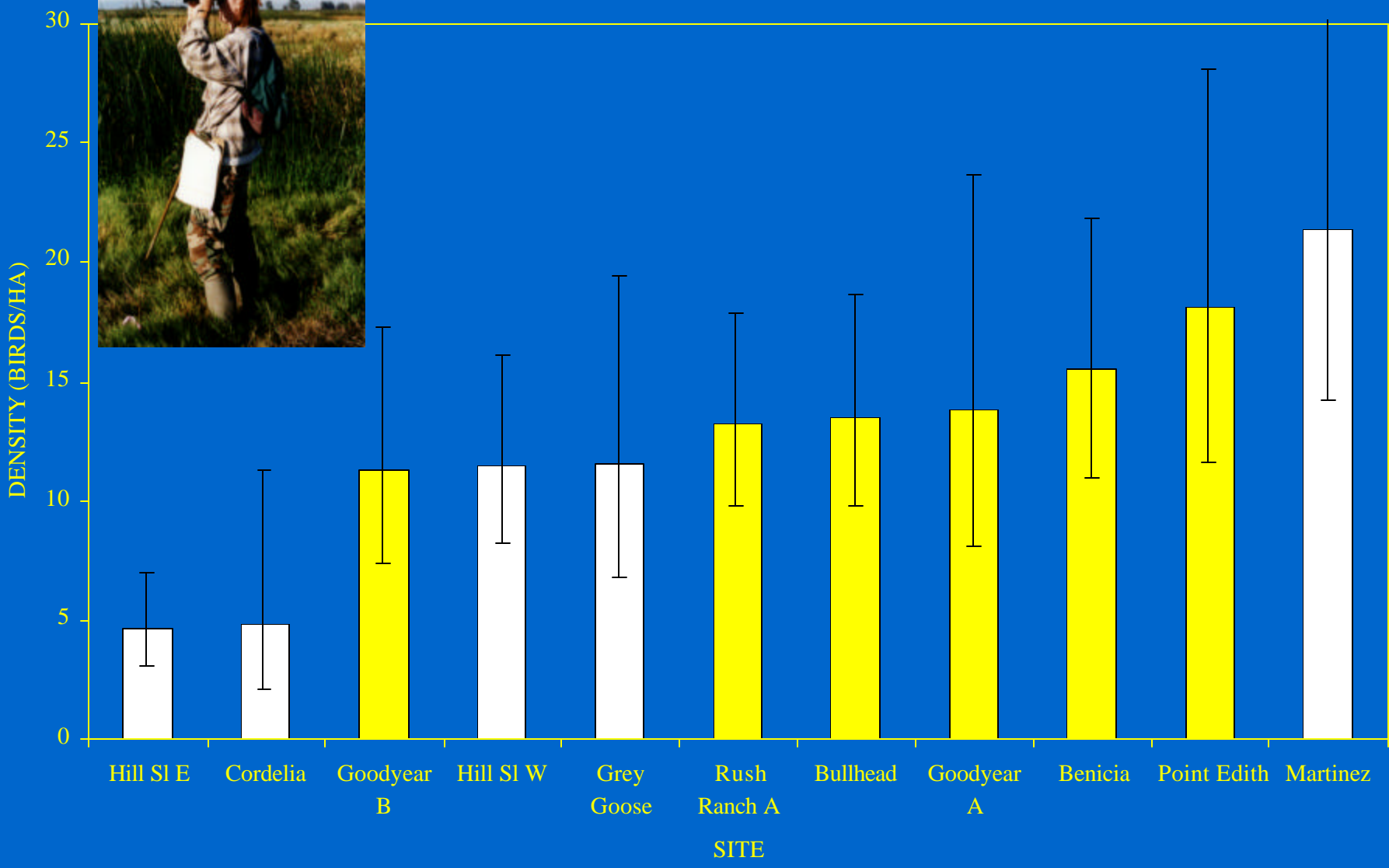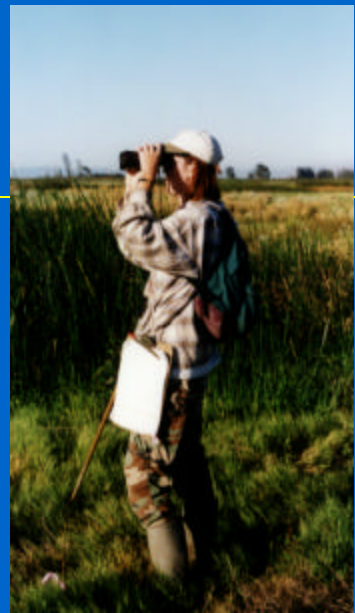Habitat and vegetation assessed at these same points.

SUISUN SONG SPARROW- ESTIMATED ABSOLUTE DENSITY
SUISUN BAY, MARCH to APRIL 2000
MEAN DENSITY IN BAY: 14.9 BIRDS/HA
(bars indicate 95% confidence interval)

Estimates of Population Size: Song Sparrows

Region	Marshall & Dedrick (1990 and earlier)	PRBO Estimate 1996	PRBO Estimate 2000
San Francisco Bay	14,800	9650	15,200
San Pablo Bay	31,200	83,400	77,400
Suisun Bay	19,100	68,000	44,500

Cause for concern: 35% decrease for Suisun Song Sparrow; will repeat population estimation in 2004

Importance of Local Habitat Features: Common Yellowthroat
Multiple Regression Model, N = 365 point count stations
Spautz, Nur, Stralberg, Chan in review

Variable	Effect	
Vegetation structural complexity	+	**P <0.001**
Scirpus maritimus **(Bulrush)**	+	**P <0.001**
Lepidium **(Peppergrass)**	+	**P = 0.001**
Proportion of shrub cover	+	**P < 0.001**
Variation among Bays (Suisun vs SF, San Pablo)		**P < 0.001**

No other local habitat variables (among the 32 examined) were significant

Statistical model accounts for 40% of variation in presence/absence observed
for Common Yellowthroat

Importance of Landscape Features: Common Yellowthroat
Multiple Regression Model
Spautz, Nur, Stralberg, Chan in review

Variable		Effect
Perimeter/Area ratio	**-**	**P = 0.024**
Proportion of Agriculture within 2000 m	**+**	**P < 0.001**
Variation among Bays (Suisun vs SF, San Pablo)		**P < 0.001**

No other landscape variables were significant

Statistical model accounts for 38% of variation in presence/absence observed
for Common Yellowthroat

Combined Local Habitat and Landscape Models: Common Yellowthroat
Multiple Regression Model
Spautz, Nur, Stralberg, Chan in review

Variable	Effect	
Vegetation structural complexity	+	P = 0.017
Scirpus maritimus (Bulrush)	+	P <0.001
Lepidium (Peppergrass)	+	P = 0.008
Proportion of shrub cover	+	P = 0.002
Perimeter/Area ratio	-	P = 0.007
Proportion of Agriculture within 2000 m	+	P < 0.001
Variation among Bays (Suisun vs SF, San Pablo)		P < 0.001

Statistical model accounts for 48% of variation in probability of occurrence
    observed for Common Yellowthroat

Results of Predictive Models: Marsh Wren and Song Sparrow

Spautz, Nur, Stralberg, Chan in review

Marsh Wren

Local Habitat Variables (R^2 = 38%):

Coyote Brush (+), Saltgrass (-), Bulrush (+)

Landscape Variables (R^2 = 32%):

Perimeter/Area Ratio (-), Distance to Upland Edge (+), Proportion of Salt Ponds within 2000 m (-)

Combined Habitat and Landscape Model: R^2 = 47%

Song Sparrow

Local Habitat Variables (R^2 = 17%):

Gumplant (+), Coyote Brush (+), Rush (-), Vegetation Cover (+)

Landscape Variables (R^2 = 19%):

Marsh Size (+), Distance to Water (+),

Land-use within 500 m:

Proportion of non-tidal marsh (-), Proportion of agriculture (-), Proportion of natural uplands (+)

Combined Habitat and Landscape Model: R^2 = 31%

Summary of Results from Modeling of Common Yellowthroat, Marsh Wren, Song Sparrow and Black Rail
Spautz, Nur, Stralberg, Chan in review

- **All species respond to local habitat features, at a fine scale.**
- **Local habitat variables can account for much of the variation in abundance or occurrence**
- **Species respond to both general habitat features and species-specific vegetation**
- **Landscape factors account for high proportion of variation in abundance/occurrence as well.**
- **Birds are not likely responding to landscape factors directly, so causal factors remain to be elucidated.**
- **Landscape models alone can provide reasonable predictive models**
  But are improved greatly by inclusion of local habitat features
- **In some cases different species responded to the same factor (e.g., Bulrush, Coyote Brush), but in other cases species responded differently.**
- **Thus no one species can be a good proxy for the other 3 species, multi-species management is called for.**

Suisun Song Sparrow Nest

PRBO's studies of reproductive ecology of Song Sparrows in San Francisco Estuary:

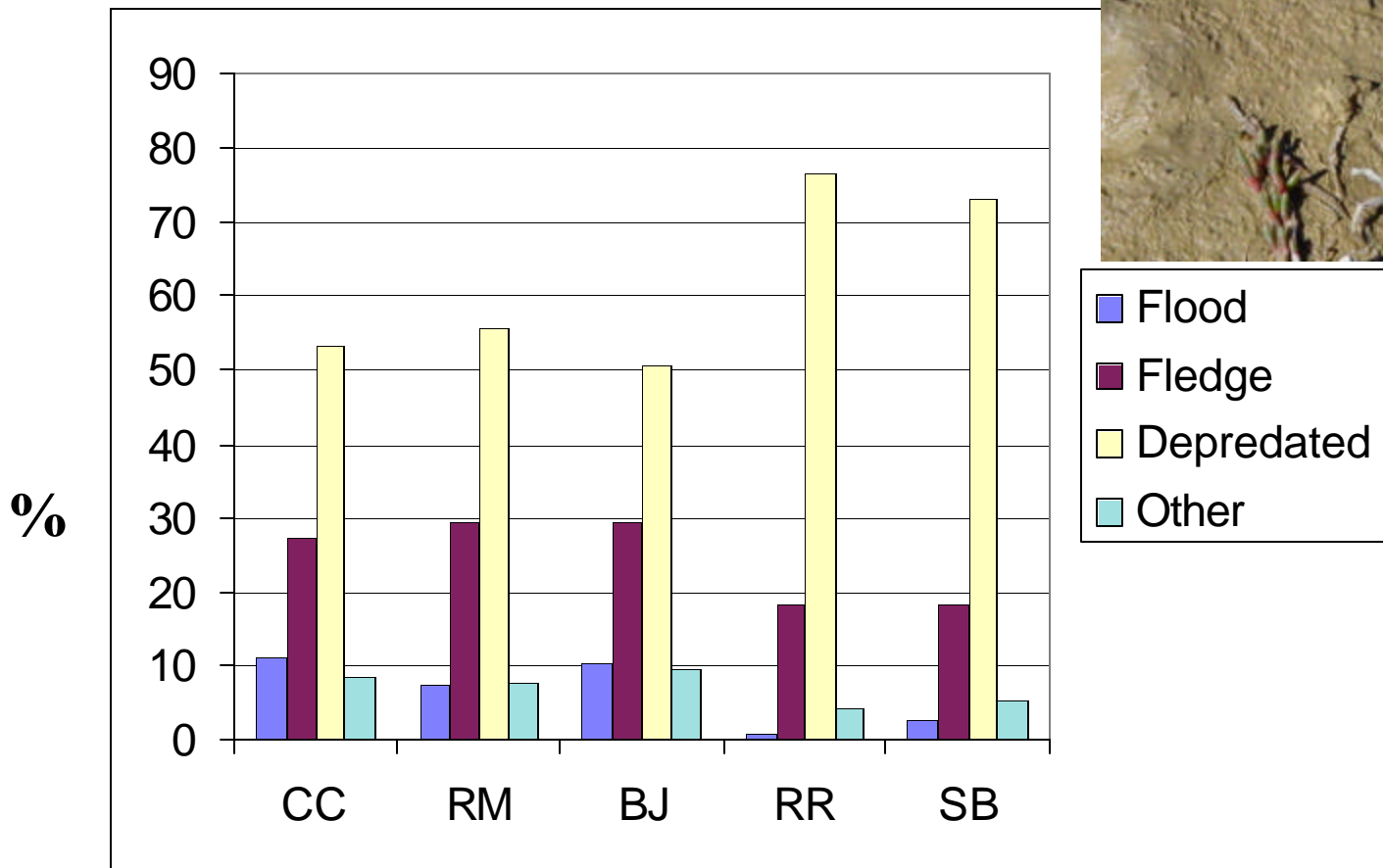5 sites (3 in San Pablo Bay, 2 in Suisun Bay) 1996 – 2003; c. 2600 nests
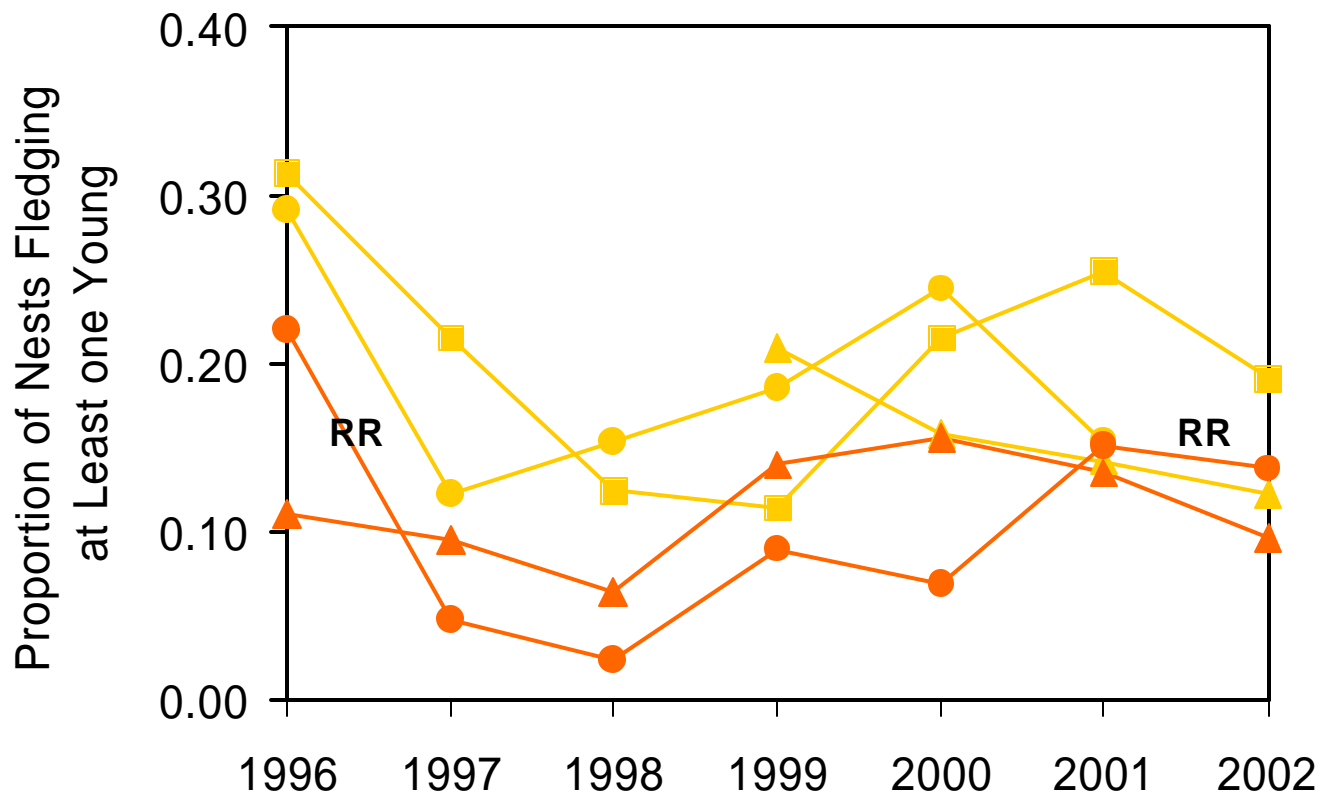
Outcomes of Song Sparrow Nesting Attempts, SF Bay

Raccoon tracks in the mud

Legend:
- Flood
- Fledge
- Depredated
- Other

%

Sites: CC, RM, BJ, RR, SB

Site Codes: RM = Petaluma River Mouth BJ = Black John Slough
SB = Benicia CC = China Camp RR = Rush Ranch

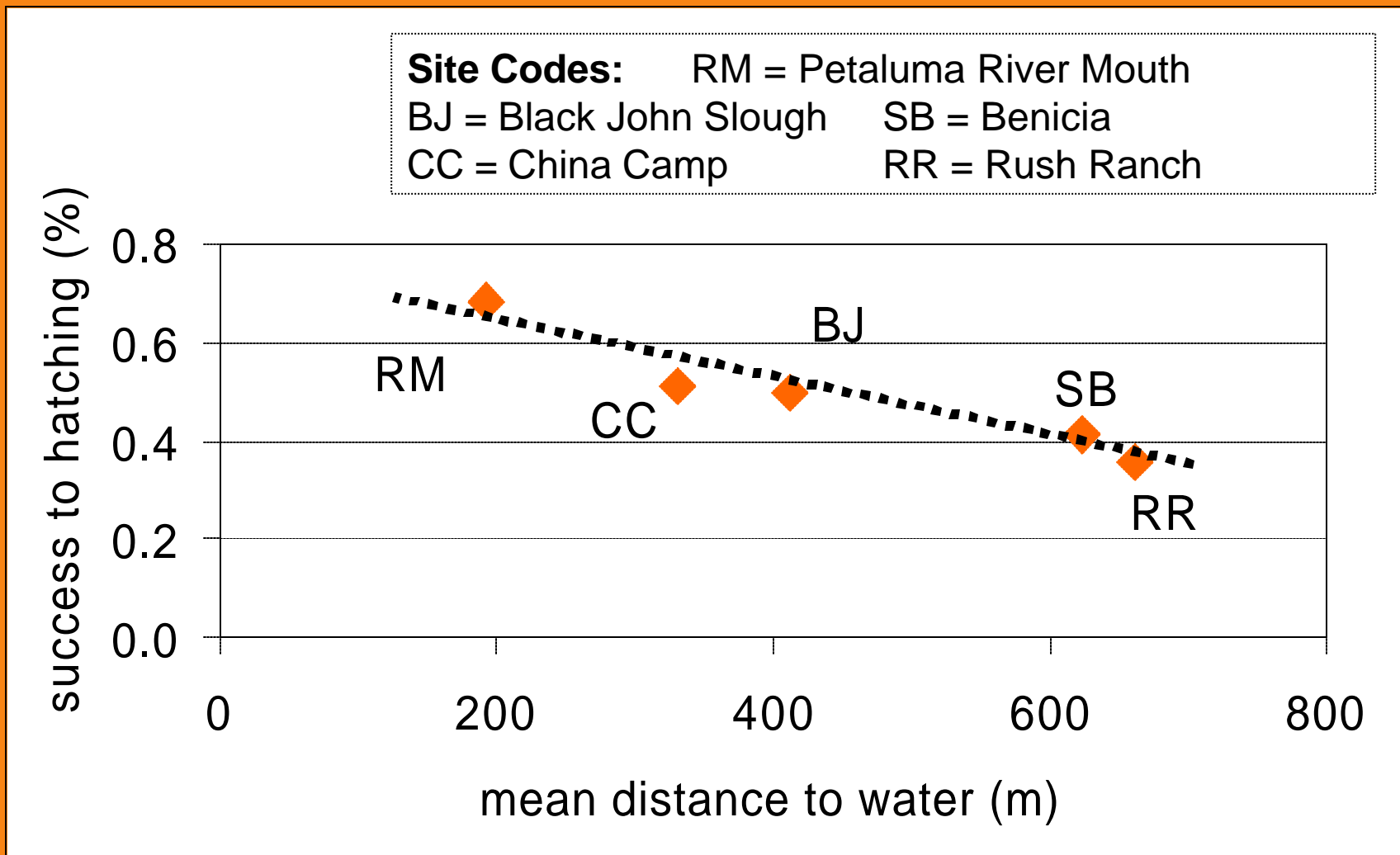# Variation in Nest survival of Song Sparrows among sites and among years

Nest survival probability is very low, especially in Suisun Bay.

Only 10 to 15% of nests survive.

Population model for Song Sparrows Indicates about 30% survival needed to maintain population stability.

Summary and Conclusions:

- Evidence for decline in population size of Suisun Song Sparrows
- Status of Salt Marsh Common Yellowthroat is not known; studies of this species are called for

- Predation is of great concern.
- Predators may be native or non-native
- Viability of populations is in question, due to low nesting success

- Each species responds differently to the set of local habitat and landscape variables; multi-species management is needed.
- Vegetation complexity and diversity is most favorable to tidal marsh species.
- Heterogeneity of marsh habitat is also important: channels are important for tidal marsh birds, and ponds and channels in marshes provide needed habitat for waterbirds.

- We are now exploring whether young, restored marshes can provide the needed vegetation complexity and diversity.

Acknowledgments

Agencies:

CALFED Bay/Delta Program (USDI, CA DWR),

EPA (National Office) and NOAA
US Fish & Wildlife Service, San Pablo Bay NWR
California State Dept of Parks and Recreation
Solano County Farmlands and Open Space
CA Dept of Fish & Game

Private Foundations:
Bernard Osher Foundation
Richard Grand Foundation
Long Foundation
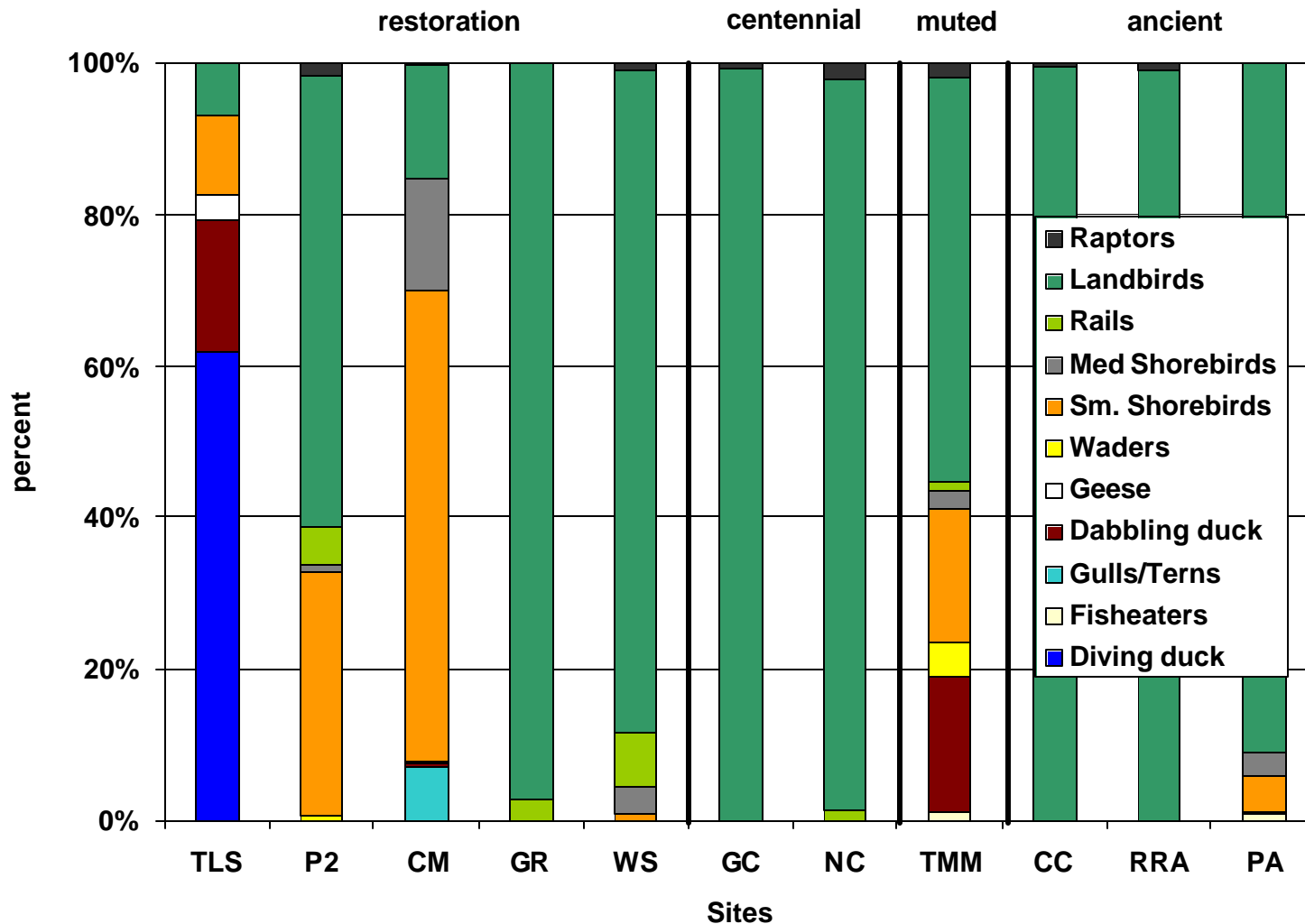Rintels Charitable Trust
Mary A. Crocker Trust

Colleagues: Yvonne Chan,Tom Gardali, Steve Zack, Jules Evens

Numerous PRBO Field Biologists and Interns

Bird point count survey stations at Carl's Marsh (Petaluma River Marsh).

Surveys conducted during fall, winter, early spring, and late spring.

Seasonal patterns in bird use: <u>Fall migration period.</u> Proportion of total contributed by each species group, September-October 2001 & 2002