

# Evaluating Wintering Waterbird Response to the West Coast's Largest Tidal Marsh Restoration Project

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# SF Bay-Delta: Critical for Migratory Birds

- Western Hemisphere Shorebird Reserve Network – over a million migrating shorebirds
- Key diving duck wintering area - 40 and 50% of Pacific Flyway scaup and scoter counted in SFB during midwinter
- North and South Bay salt ponds - important winter habitat components
  - 40% of Bay waterfowl in South Bay ponds
  - 15% in North Bay ponds (*Richmond et al. 2014*)



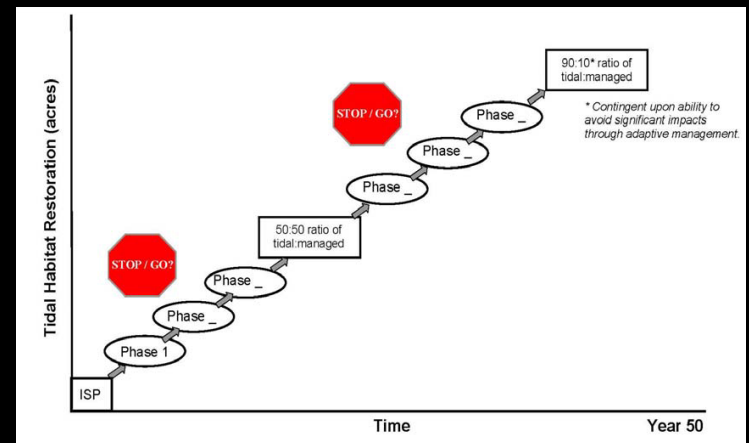
# South Bay Salt Pond Restoration

## Goal:

South Bay Salt Pond Restoration Project (SBSP) - Restore 50 to 90% of former salt production ponds to tidal marsh while maintaining the rest as foraging and roosting areas for migratory birds

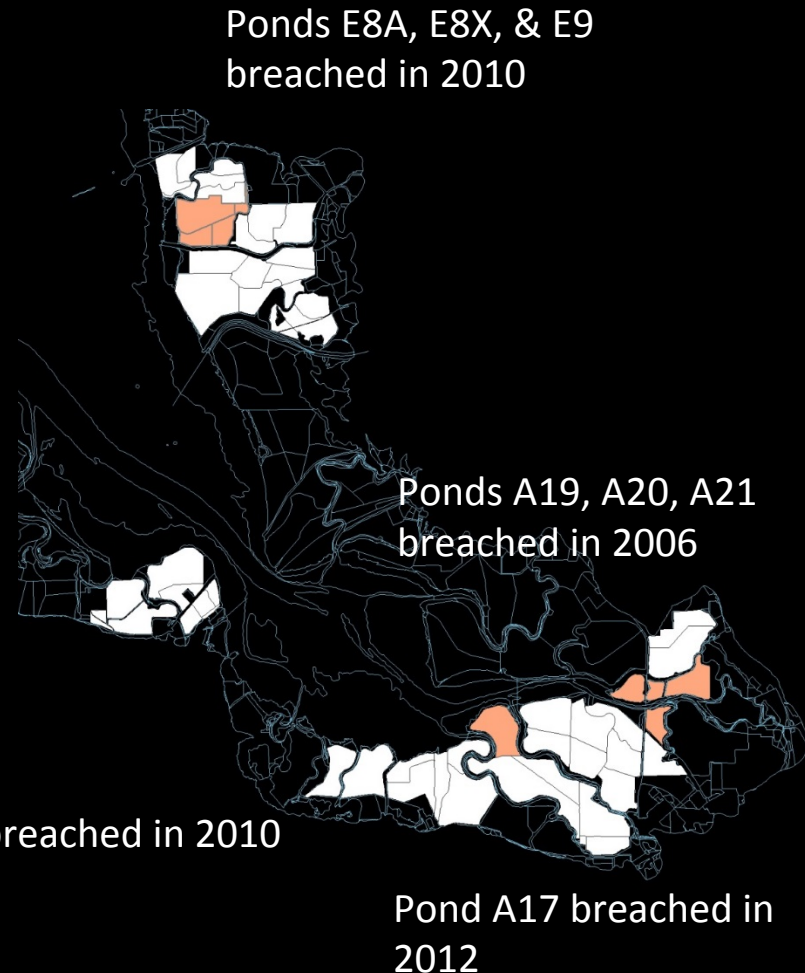
## Central challenge:

How to maintain or improve migratory waterbird populations given conversion to tidal marsh?



# Initial Restoration Phases

- 2003: CDFW and USFWS purchase ponds
- 2004 - 2008: Interim Stewardship Plan (ISP)
  - Salinity and water depth management
- 2009 - 2013: Phase I Restoration
  - 10% of Project ponds currently breached
- 2002 – 2012: USGS Surveys
- 2013 -14: SFBBO Surveys





# Questions

- Has avian abundance changed after initial restoration actions ?
- What pond habitat features are important to different avian guilds ?
- How are birds responding to efforts to optimize managed ponds?





Has avian abundance changed after initial restoration actions?





# Methods

## Data collection

- Monthly counts at HT
  - 53 Ponds
  - Grid based counts
  - Water quality
  - Depth



## Data analysis

- Abundance trends via LOESS (locally weighted scatterplot smoothing)
  - Winter only (Dec –Feb)

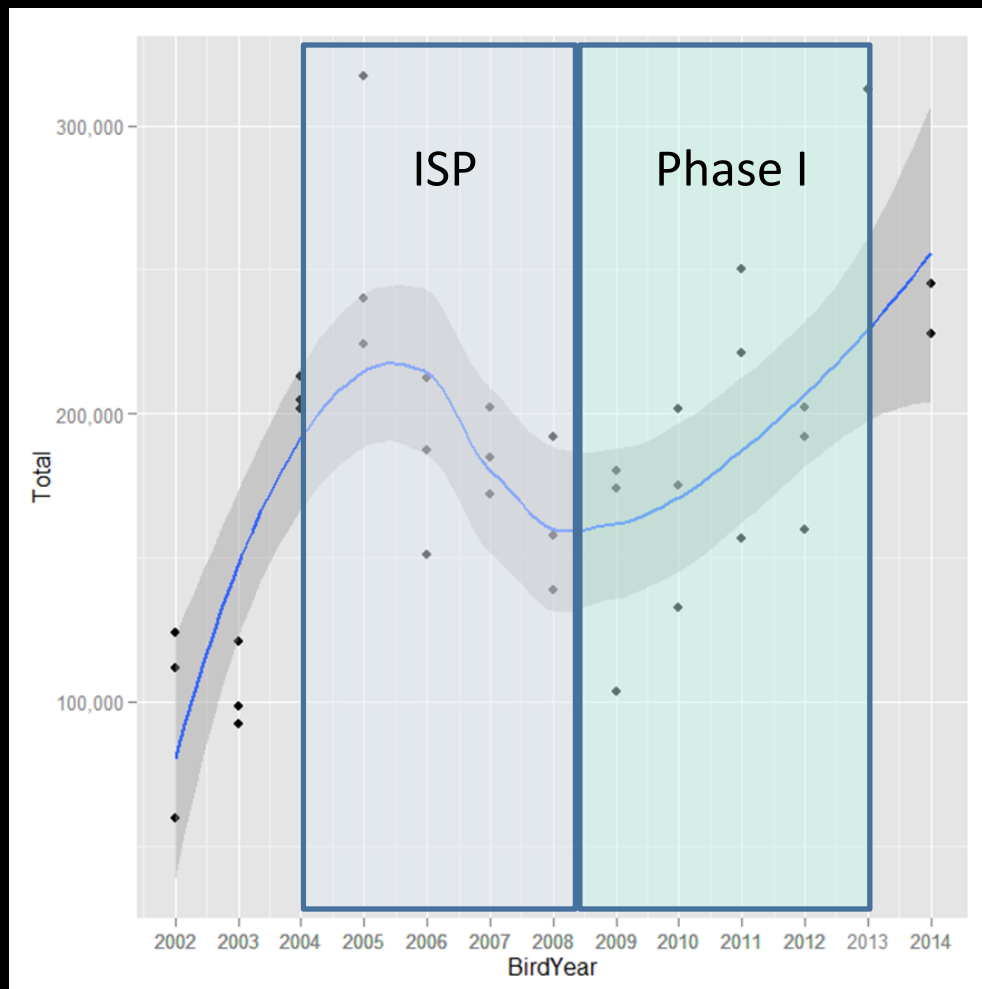


# Avian Guilds



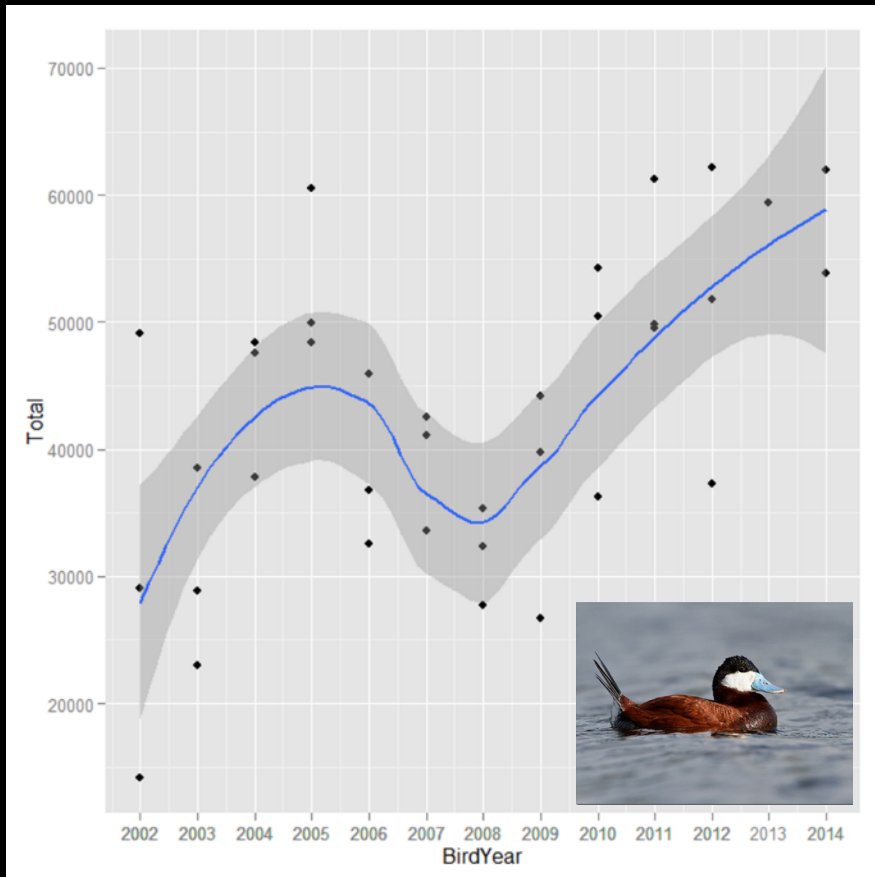


# South Bay Wintering Bird Abundance

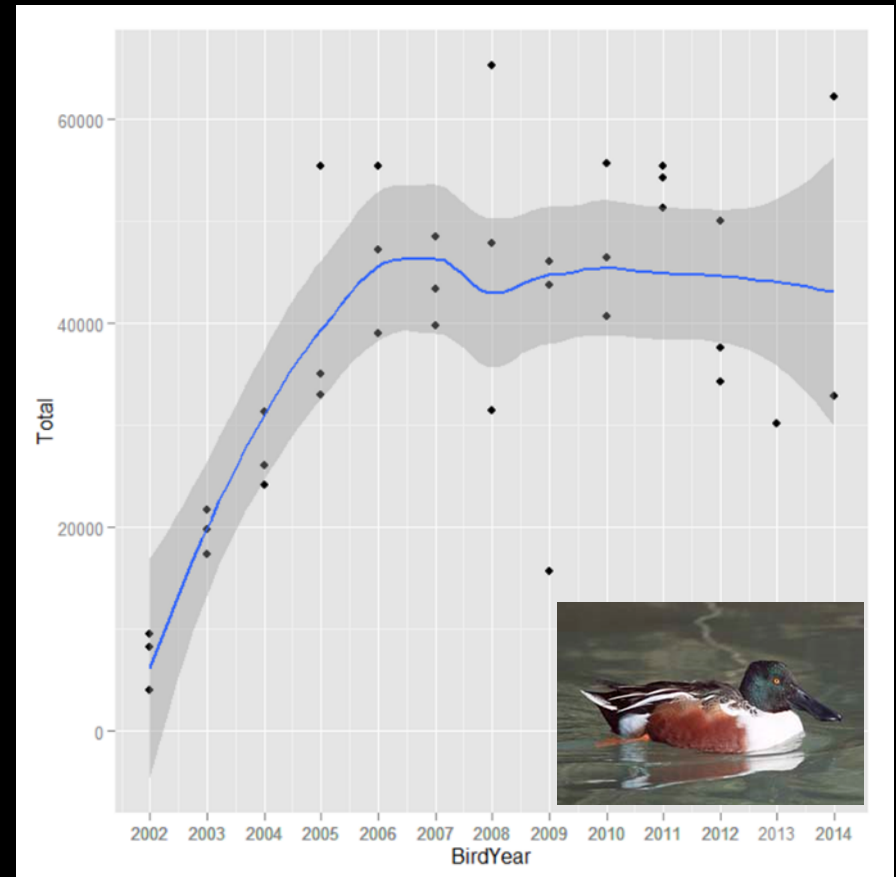


# South Bay Wintering Waterfowl

## Diving Ducks

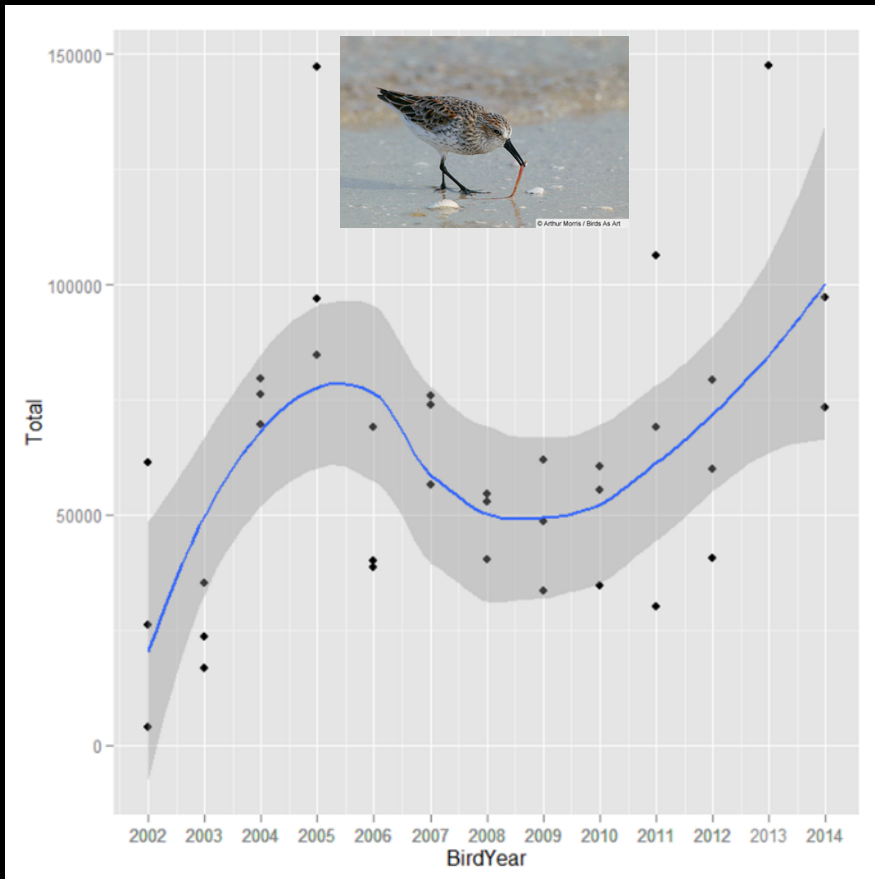


## Dabbling Ducks

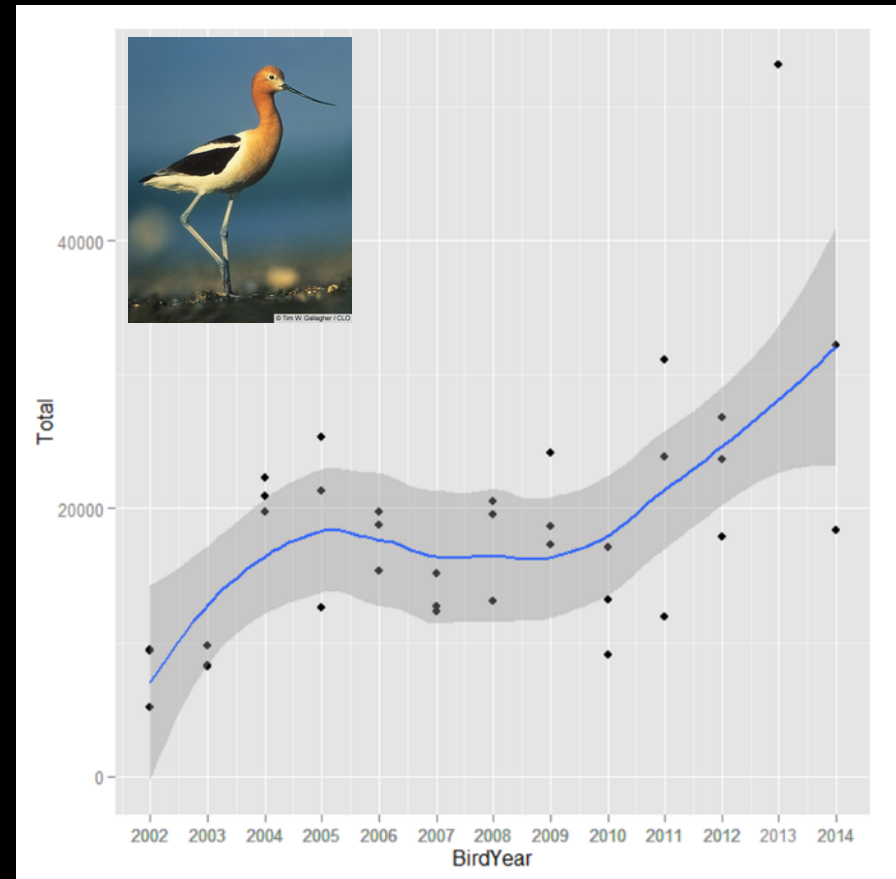


# South Bay Wintering Shorebirds

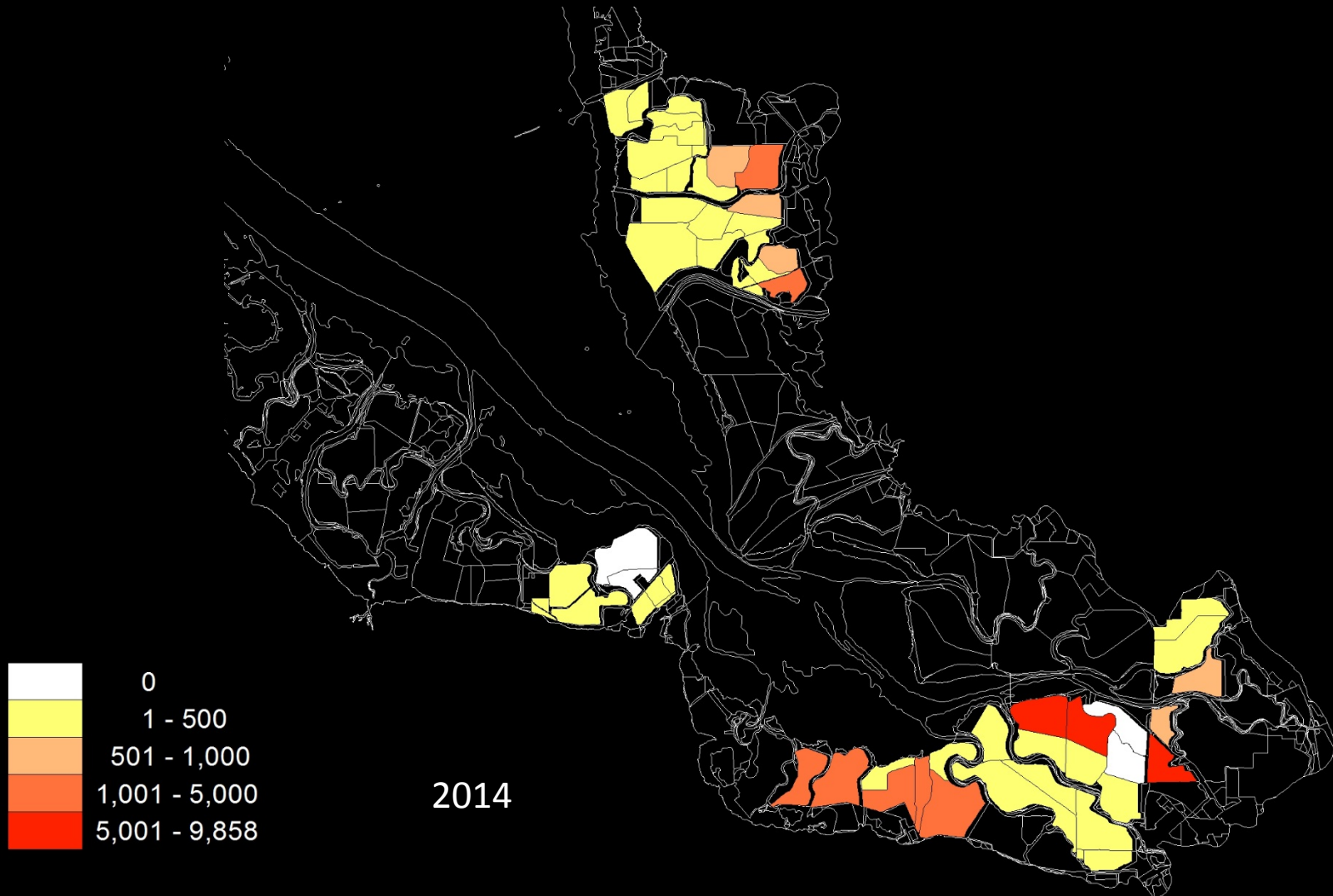
## Small Shorebirds



## Medium Shorebirds



# South Bay Dabbler Distributions





# What pond habitat features are important to different avian guilds ?



Katz.photos

# Modeling Methods

Time period: Oct to Apr 2003-2015

Response variables: Foraging and roosting abundance of several species and guilds

Predictor variables: Pond area, water depth, topography, mean salinity, distance to Bay and urban, pond management (breached or not), island presence, hunting access, public access

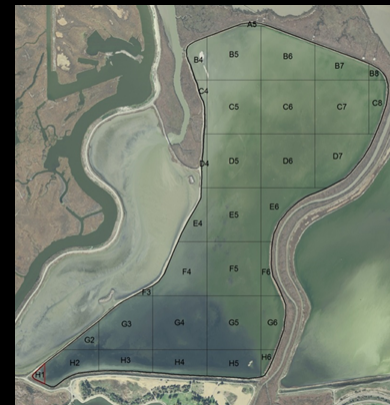
Analysis: General Linear Mixed Model (GLMM) with negative binomial distribution. Model selection (AIC) and model averaged coefficients across all models.

Scales:

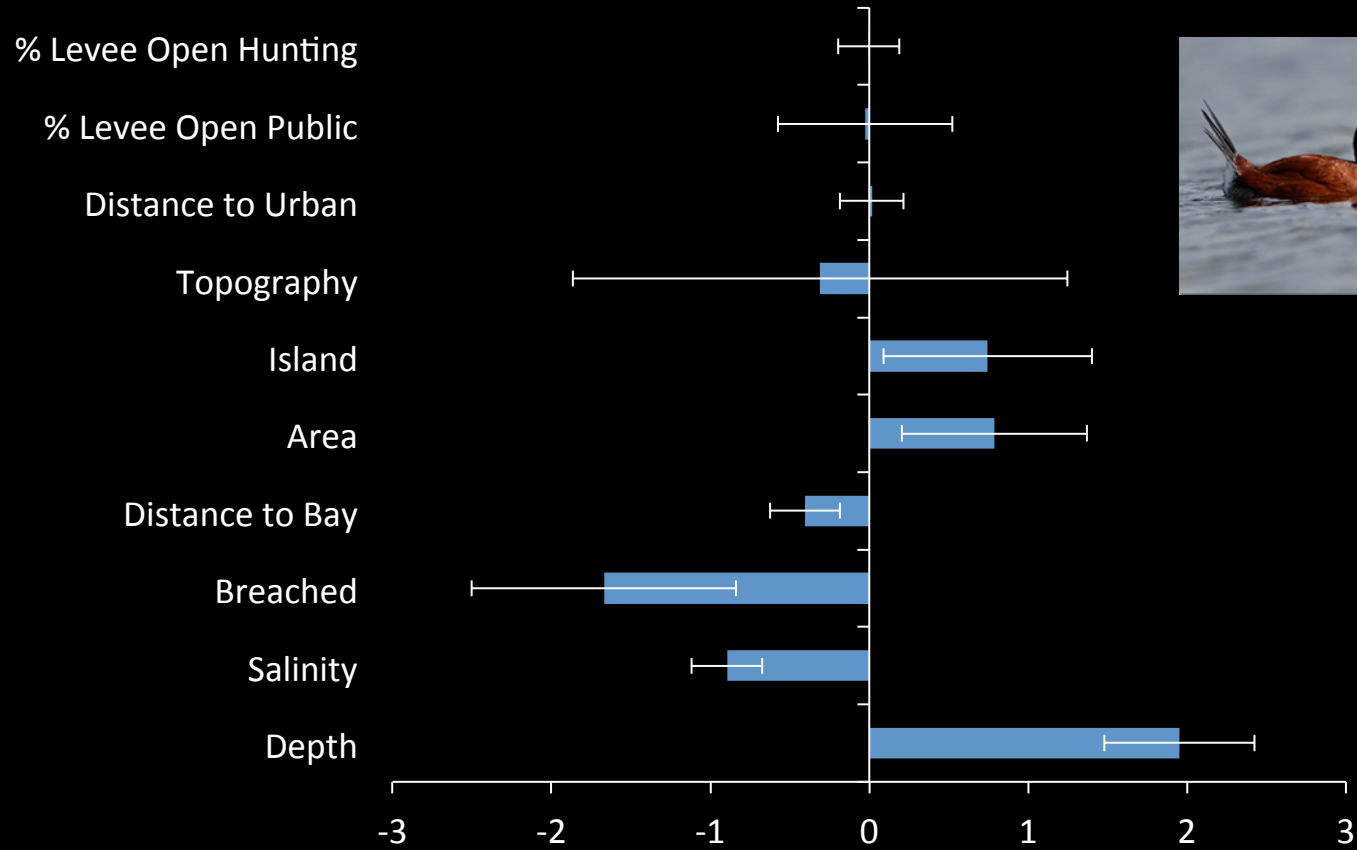
Pond Scale



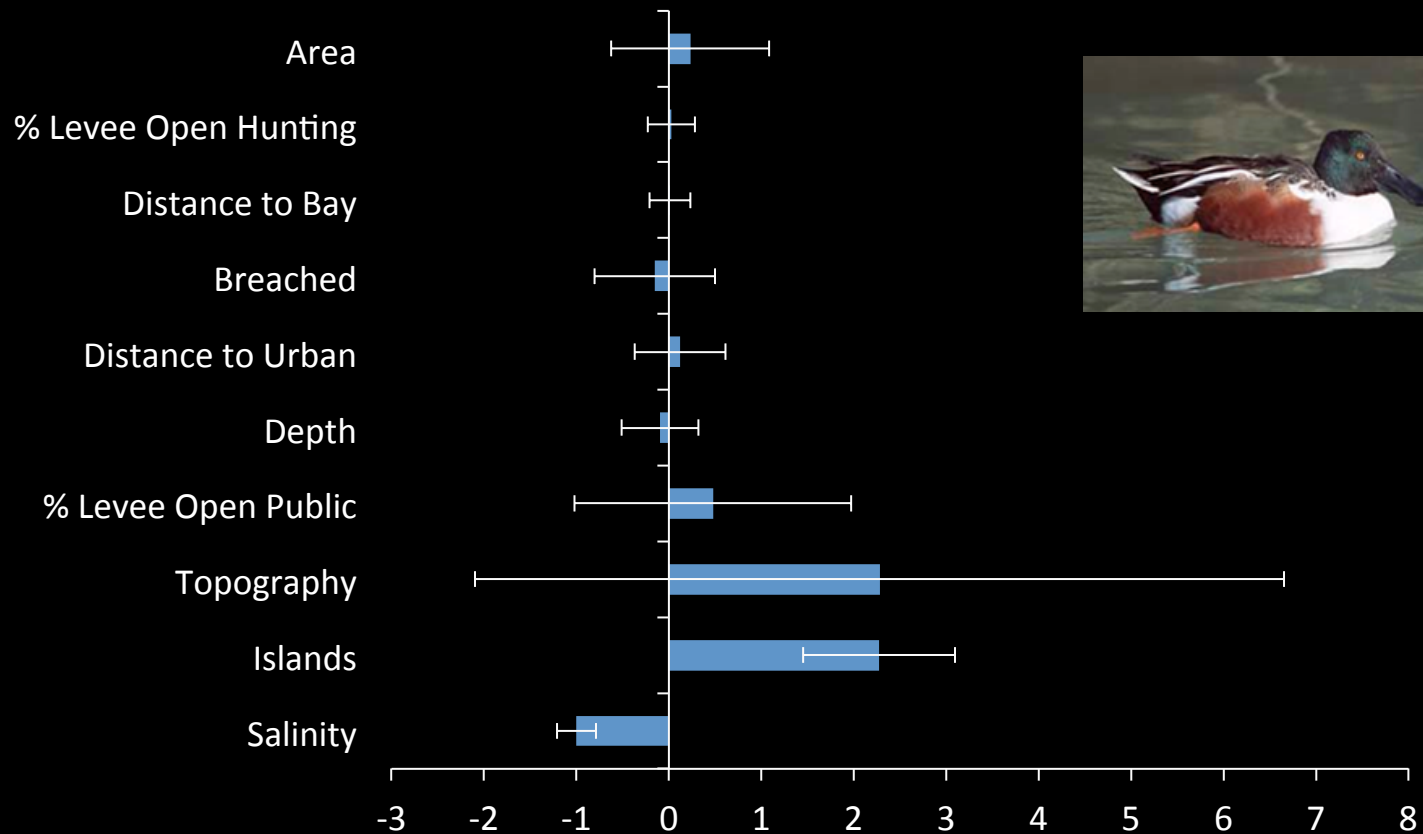
Grid Scale



# Foraging Diving Ducks

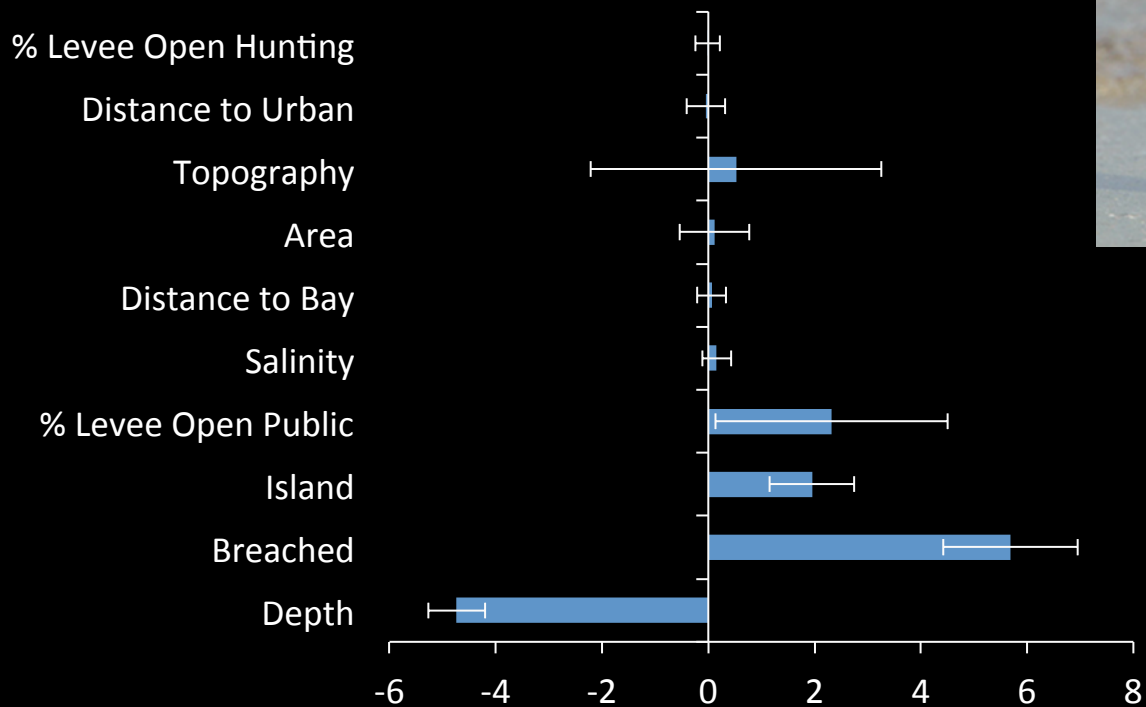


# Foraging Dabbling Ducks

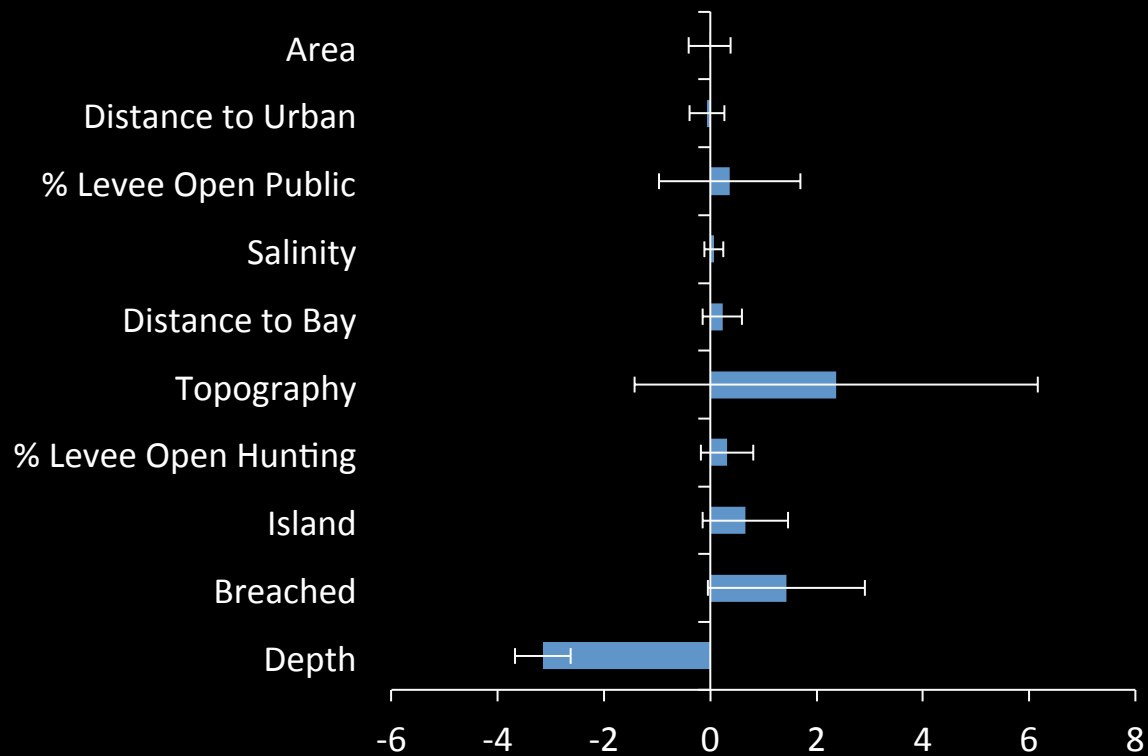




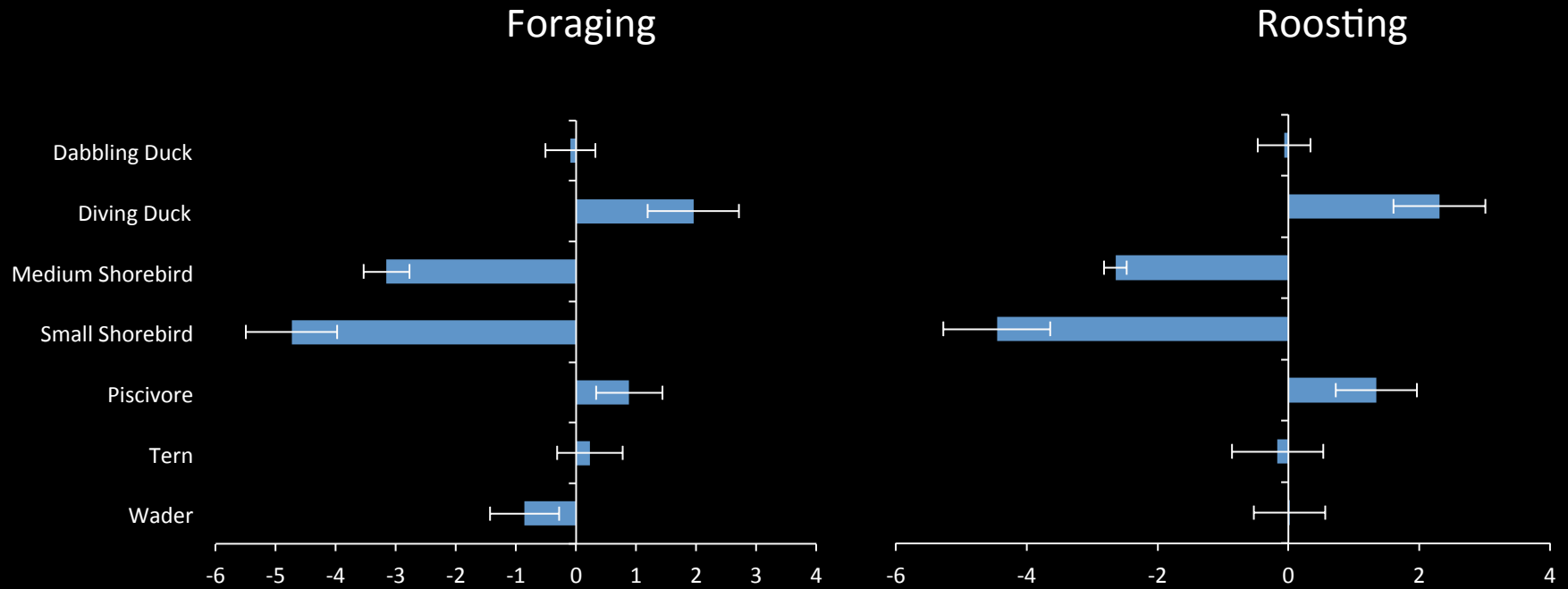
# Foraging Small Shorebirds



# Foraging Medium Shorebirds



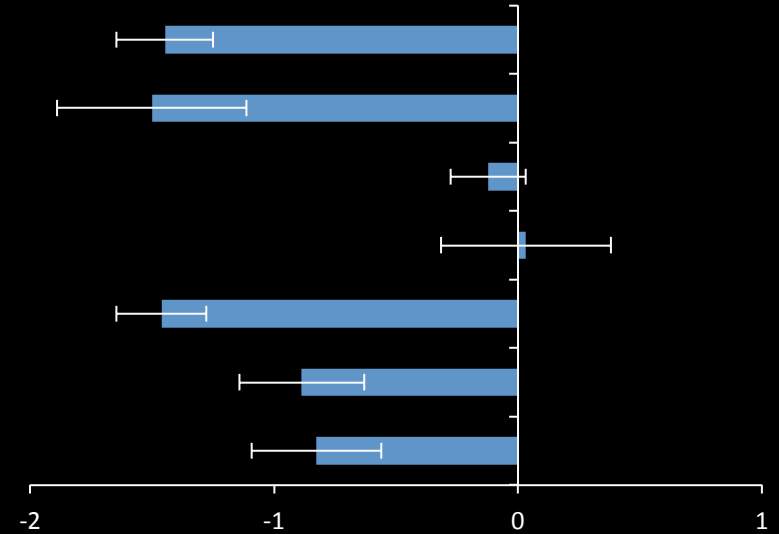
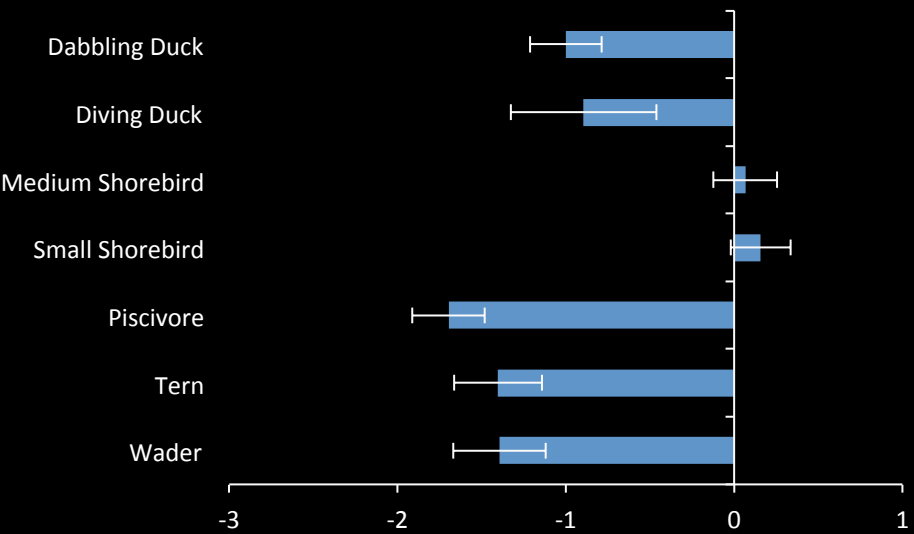
# Pond Depth



# Pond Salinity

## Foraging

## Roosting





# How are birds responding to efforts to optimize managed ponds?

Tidal restoration will result in fewer open water habitats for shorebirds and waterfowl. How can we optimize remaining ponds?

## Current Applied Studies:

- 1) Island characteristics that support wintering and nesting waterbirds
- 2) Shorebird response to experimental manipulation of salinity, depth, and foraging mounds
- 3) Diving duck response to mixed-species management of ponds
- 4) Salinity and inundation modeling of experimental ponds



# Multi-Species Pond Management

## Management Question:

Can we increase pond utility using mixed-species management – lower water levels in summer for snowy plover nesting, raise in winter for diving duck foraging?

## Research Objectives:

- 1) Evaluate physical and landscape characteristics that enhance diving duck abundance in managed ponds
- 2) Determine if water flow and quality in winter allow for benthic prey colonization
- 3) Determine if diving ducks are foraging in ponds and what they are eating



# Optimizing Salinity and Foraging Area: Eden Landing E12/13

## Management Question:

How can we sustain or increase waterbird populations in fewer open water areas?

## Research Objectives:

- 1) Determine the optimal salinity and depth conditions for waterbirds during winter and spring migration
- 2) Test the value of creating small foraging berm features in these ponds to benefit feeding waterbirds
- 3) Create manager tool to predict salinity values in cells under different management actions

## Partners :

CA Dept. Fish and Wildlife,  
Ducks Unlimited, CA Wildlife Conservation Board,  
USGS PES, CA Coastal Conservancy



# Summary and Conclusions

- Abundance Trends:
  - Most guilds displayed increasing trends during the initial restoration phases
  - Response may be in part due to lowered salinities and manipulated depth of managed ponds
- Preliminary results from on-going habitat modeling suggest:
  - Foraging diving ducks and small shorebirds abundances were associated with several predictors, dabblers with salinity, medium shorebirds with depth
  - The importance of different habitat features varies among waterbird guilds, indicating that a suite of management methods across multiple ponds may be needed to maintain species diversity
- Continued efforts to optimize the performance of managed ponds will be imperative to maintain migratory bird numbers as breached habitats transition to tidal marsh



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**Management Agencies:** USFWS, CDFW, State Coastal Conservancy

**Collaborators:** SFBBO, PRBO, Ducks Unlimited, Moss Landing Marine Labs, San Jose State University, San Francisco State University



# Eared grebes

