DIVING DUCK RESPONSE TO MIXED-SPECIES POND MANAGEMENT AT EDEN LANDING ECOLOGICAL RESERVE

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Importance of SFB for wintering diving ducks

- 36% of Pacific flyway ruddy ducks
- 44% of Pacific flyway scaup

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Cosco Busan oil spill

- 6849 birds killed, 65 species
- >1100 diving ducks
- 305 "small diving ducks"

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CDFW Bird Injury Fact Sheet, (Feb 2008)

Restoration Project: Mixed species pond management

- Complements on-going efforts to restore the South Bay Salt Ponds
- Maintain and manage pond habitat for wintering Lesser Scaup and other small diver species
- Same ponds managed for Snowy Plover nesting during the summer

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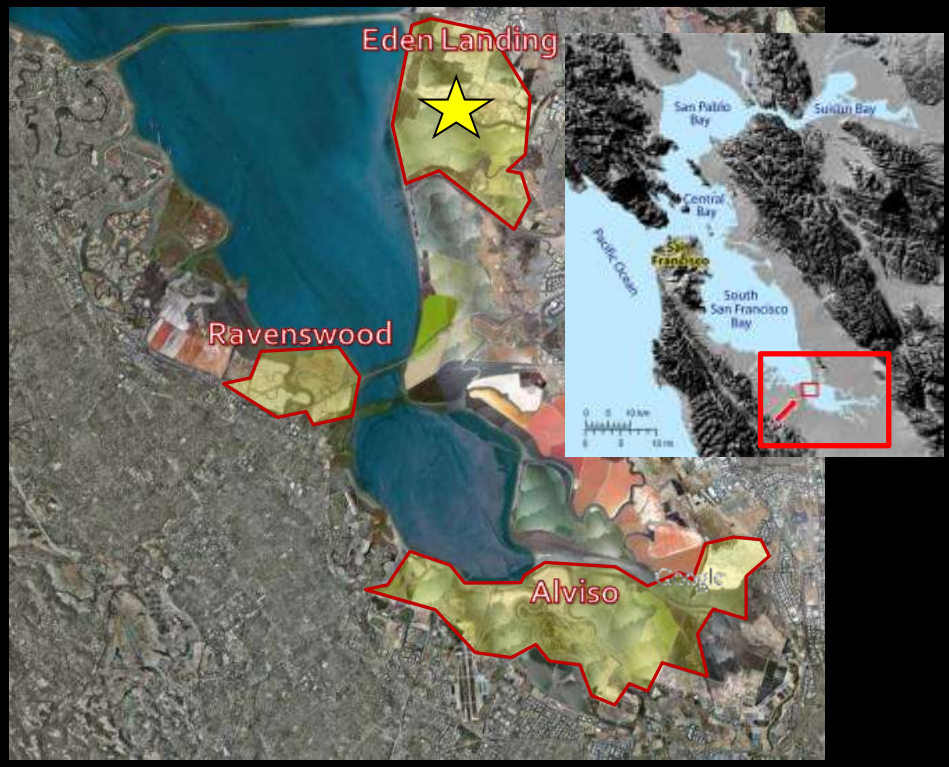
South Bay Salt Pond Restoration

- Largest tidal wetland restoration on west coast
- Mixed species management
  - Winter: deep, circulating water
  - Summer: dry with water circulating only in borrow ditches
- Past: 95% of diving ducks in ponds used those with circulating water all year
- How can we optimize mixed species management for wintering diving ducks?



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Research Questions

- What pond characteristics attract diving ducks?
- Are diving ducks using mixed management ponds in comparison to ponds filled year round?
  - How are they using ponds?
- Do benthic invertebrates (a.k.a. diving duck foods) persist over summer when pond is mostly drained?
  - What species?
  - Where? Borrow ditches, natural channels, panne
- How quickly do invertebrates colonize when ponds fill?
- What are diving ducks eating in managed ponds compare to ponds filled year round?

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Project Objectives

1. Identify physical and landscape characteristics of ponds that enhance diving duck abundance

2. Measure diving duck densities and behavior in mix-management ponds compared to year-round circulation ponds

3. Evaluate diving duck diet and benthic prey availability in mix-management ponds compared to year-round circulation ponds

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Obj 1 Methods: pond characteristics

- 10 years grid-based duck density data from monthly counts of 57 SBSP ponds
- Information theoretic (AIC) approach to evaluate suite of models (GLMM) relating diver densities to:
  - Depth
  - % accessible area
  - Salinity
  - Distance to landscape features (Bay, levee, urban)
  - Prey resources
  - Other pond features
- Modeling in progress – results expected early 2015

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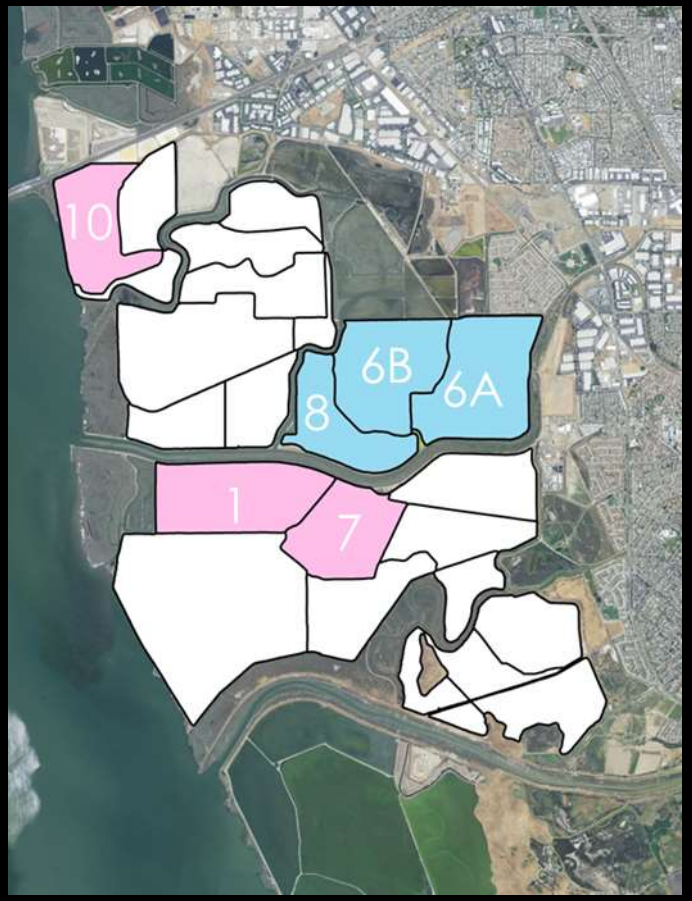
Methods: project and reference ponds

- **3 project ponds** - **6B, 6A, 8**
- Seasonal 2005 to 2008 – just took in rainwater
- 2008 put in water control structures
- 2011 - circulation in borrow ditches throughout the year
- Managed for <44 ppt salinity

- **3 Reference Ponds – 1, 7, 10**
- Circulating ponds, filled all year



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Obj 2 Methods: duck densities and behavior

- Avian Surveys:
  - Complete pond counts
    - 2X per month
    - 250 m^2 grids

  - Behavioral scans on 20% of total for each species
    - Species = scaup, ruddy duck, bufflehead
    - Randomly chosen individuals
    - Watch 10 sec, record last behavior
    - Reduces bias towards missing foraging behavior

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Obj 3 Methods: prey availability and diet

- Prey Availability:
  - Oct, Jan, Mar
  - 18 sampling locs per project and reference pond
  - Stratified random – 6 each in:
    - borrow ditches, natural channels, pannes
  - Benthic cores – 3 replicates
    - Rinsed through 0.5-mm sieve, identified, enumerated, biomass
  - Water quality – continuous

- Diet:
  - Hunter Collections
  - Esophagus and proventriculus prey items:
    - Identified, enumerated, dry biomass
  - Percent Index of Relative Importance (IRI)
    - IRI = (%N+%DW)*%FO
    - Alleviates bias of using any one index alone

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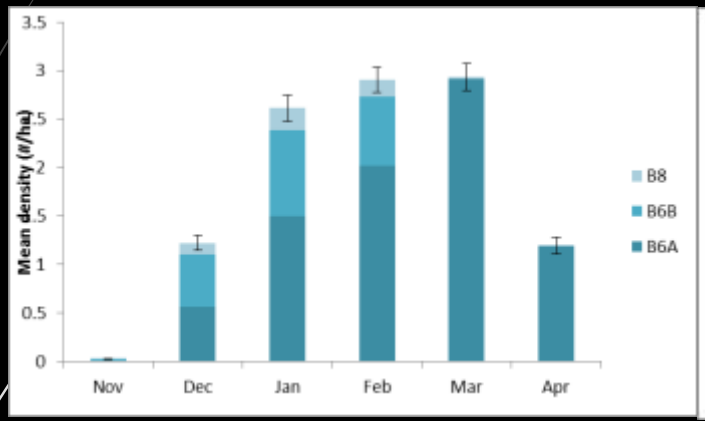
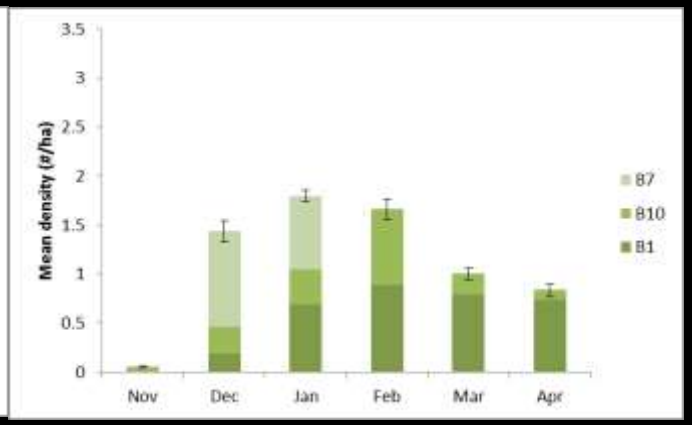
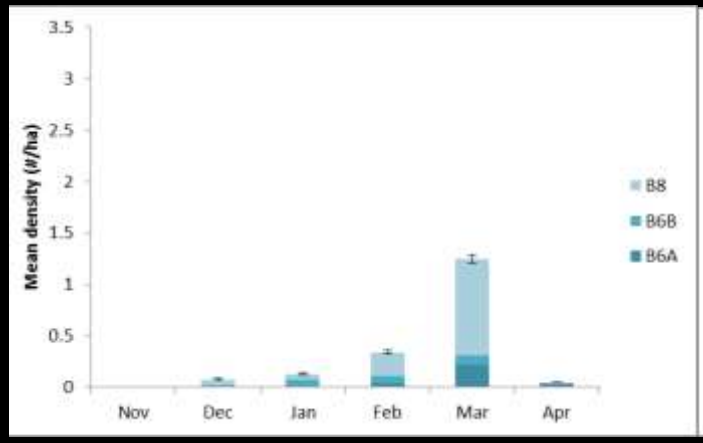
Duck densities

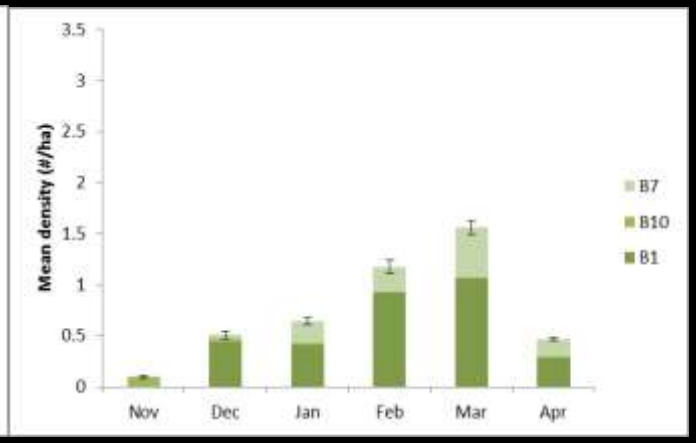
Ruddy ducks – higher densities in project ponds





Scaup – higher densities in reference ponds





Project

Reference

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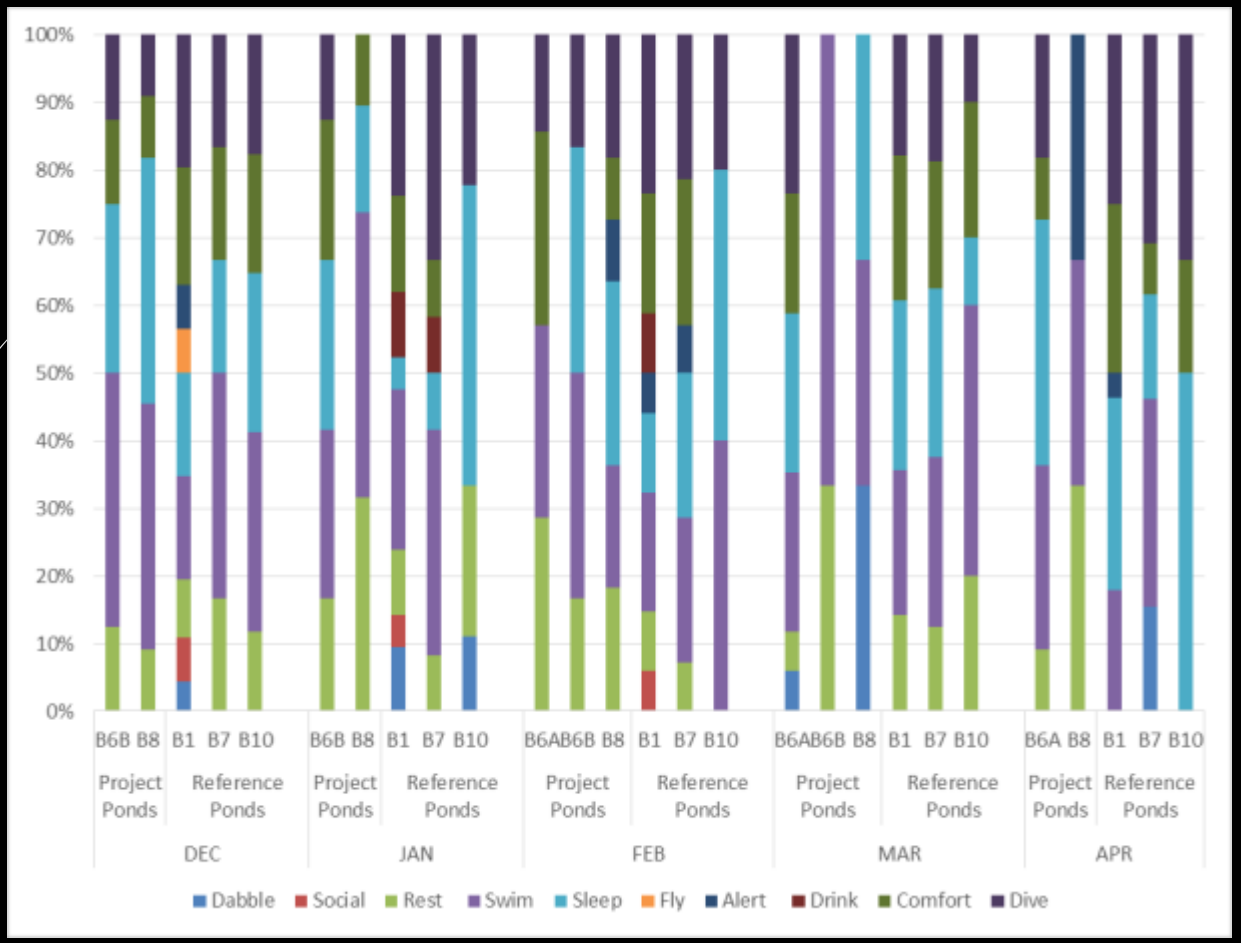
Ruddy duck behavior

N = 455

Scaup behaviors – scan results



N = 408

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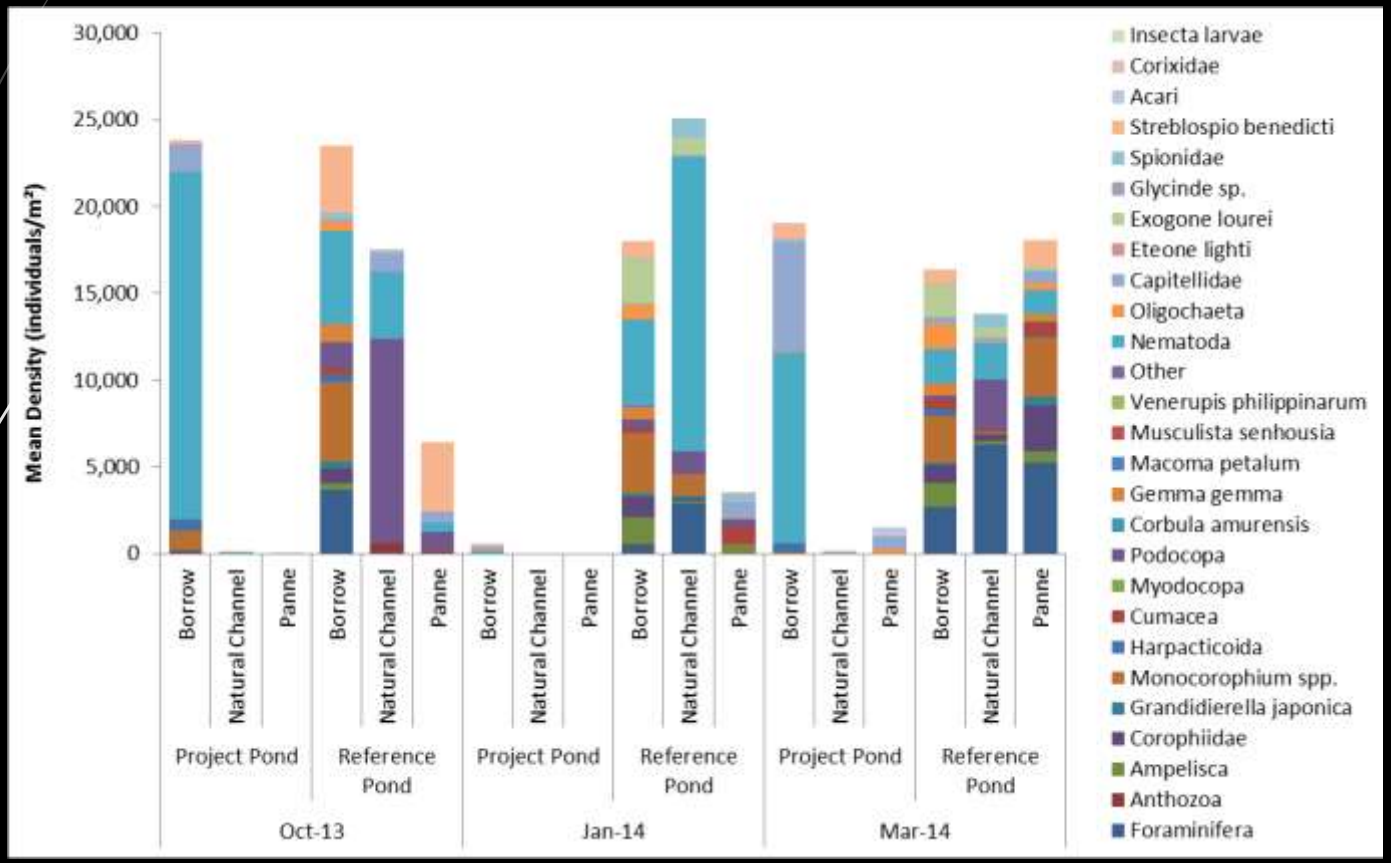
Invertebrate densities across pond features



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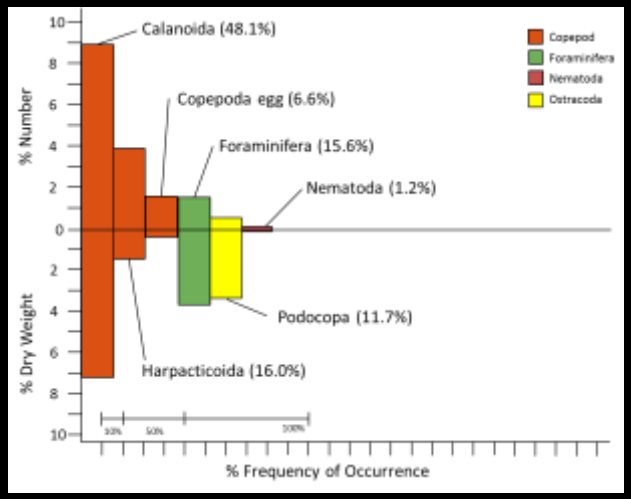
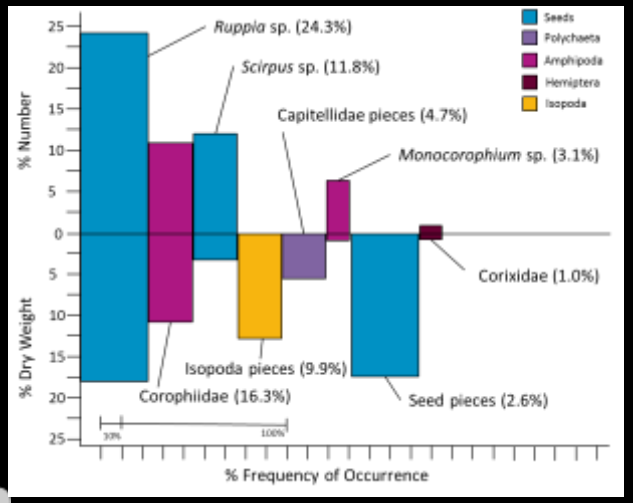
Ruddy duck diets in project ponds

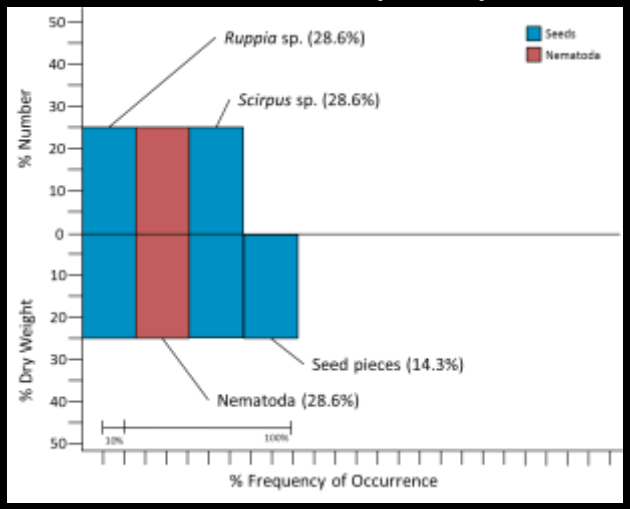
B6A, (N=6)



B6B, (N=9)



B8, (N=4)



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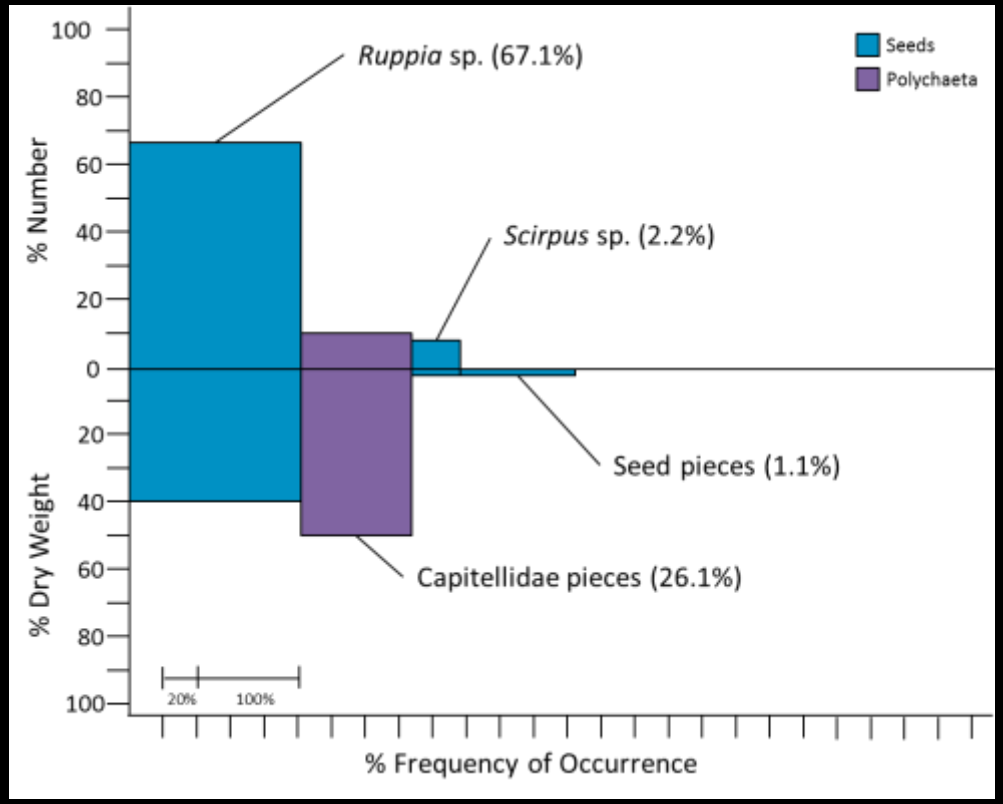
Includes all taxonomic groups with ≥ 1% IRI value.

Ruddy duck diets in reference ponds

- All birds harvest in B1 and B10 had empty GIs
- Few species in diet
- Difficulty in getting diet information on hunt days
- Are hunters harvesting birds foraging in ponds?

B7, (N = 3)



Includes all taxonomic groups with ≥ 1% IRI value.

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Discussion

- Preliminary results from our first year of work suggest:
- Higher scaup densities in reference ponds and higher ruddy ducks densities in project ponds
- Similar behaviors between project and reference ponds with foraging comprising less than 30% of observed behaviors of both scaup and ruddy ducks in all ponds
- Ruddy duck: declines in foraging in project ponds during Mar and Apr when water draining
- Invertebrate densities and species richness appeared higher in reference ponds during some seasons
- Within pond features in project ponds, borrow ditches appeared to harbor higher densities of invertebrates
- IRI analyses suggest diets differ among all ponds – perhaps a function different salinities, small sample sizes, lack of foraging on hunt days

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Upcoming work

- Finish Objective 1 – modeling pond characteristics
- Scientific collections on non-hunt days?
- Evaluate relationships between water quality parameters and invertebrate densities, species richness
- Add epibenthic sweep and aquatic invertebrate sampling to evaluate prey availability in water column

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Acknowledgments

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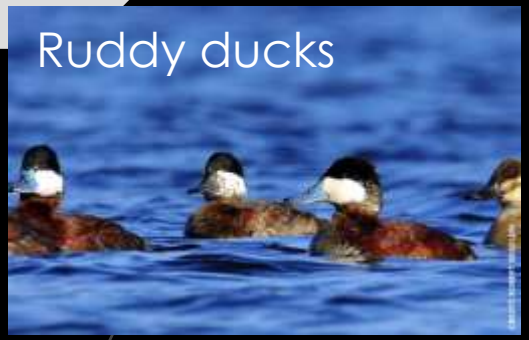
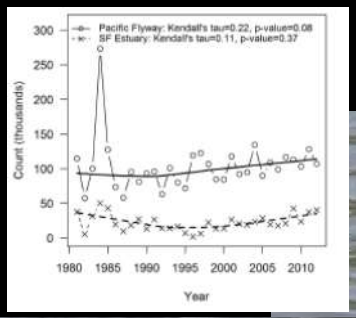
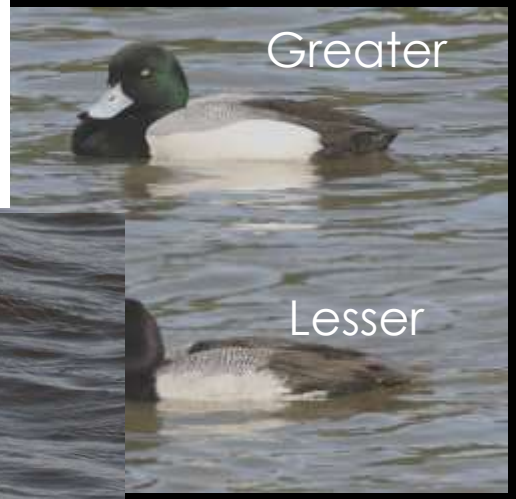
- Thank you to our hard-working field and lab crew: Tanya Graham, Sara Piotter, William Chan, Jessica Donald, Charlie Norton, Emily Schultz, Laura Hollander, Chris Knight, Lizzie Bonzech

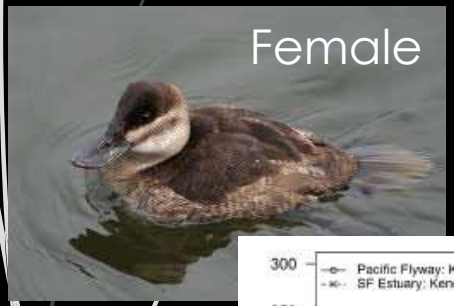
- Bay Salt Pond Restoration Project

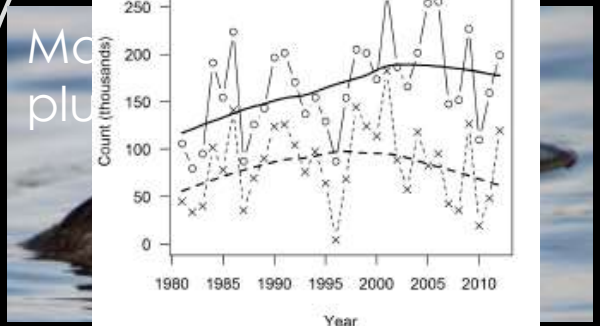

Ruddy ducks


Pacific Flyway: Kendall's tau=0.22, p-value=0.08
SF Estuary: Kendall's tau=0.11, p-value=0.37
Count (thousands)
Year

Scaup


Greater
Lesser


Female


Pacific Flyway: Kendall's tau=0.27, p-value=0.03
SF Estuary: Kendall's tau=0.04, p-value=0.73
Count (thousands)
Year


Female

Outline

- Oil spill and diving duck losses
- SFB and wintering divers
- NRDA Trustees requirements for restoration
- Salt pond project and mixed species management
- Eden Landing managed ponds and timeline
- Project Objectives
- Methods – Obj 1 pond characteristics – underway
- Methods – Obj 2 pond use and behavior - Include map of project ponds
- Methods – Obj 3 diets and prey preferences
- Results
  - Obj 2 Densities by pond
  - Obj 2 Scan behaviors across ponds
  - Obj 3 RUDU Diets – FO vs % # graphs
  - Obj 3 RUDU Diets – IRI results
  - Obj 3 Pond Invertebrates – By reference and treatment
  - Obj 3 Pond Invertebrate – By pond characteristics
- Conclusions and managements implications

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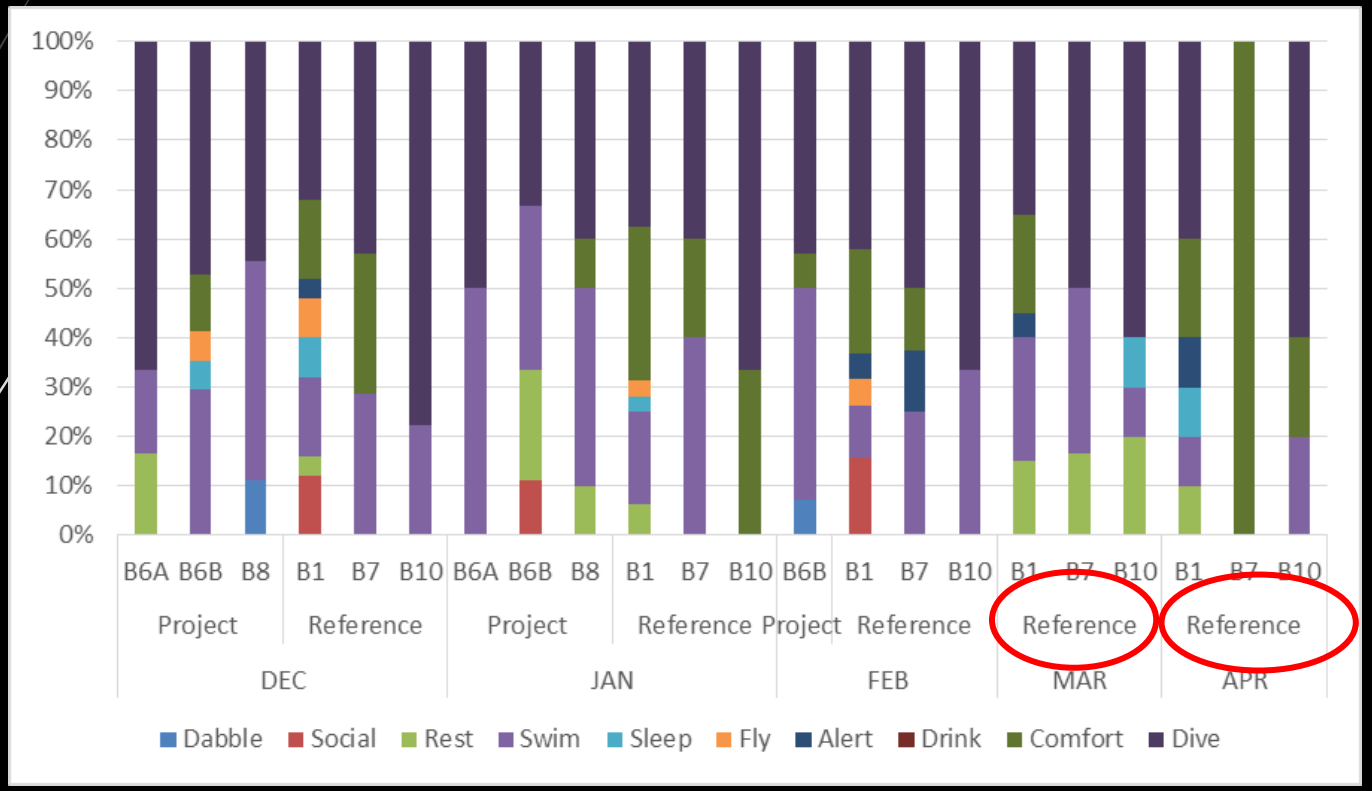
Bufflehead behavior



N = 455

Managing for multiple species

- Managed for plovers originally, but in winter
- Seasonal management from 2005 to 2008 – just took in rainwater – but then had discha
- 2008 put in more water control structures – 6A into north creek - all ponds could be independent and intake and
- 2008 – 2010- took 2 years to have low enough salinities to
- Now can operate all ponds in isolation,
- 6A is operated a little deeper for recurves – more resident watering birds
- 2011 - circulation throughout the year starts in
- Fully implemented ISP design with more flexibility
- Now fine tuning
- Pond 8 – 22 May 2014 Draw down,
- Pond 6B – 19 March 2014 started draw down – 2 weeks to get to a foot – Ready for plovers by 22 May 2014; Winter flood up started up 14 Nov 2013 (some water on in Aug and Sept for shorebirds moving thru but not muchj
- Pond 6A – 19 March 2014 draw down; 19 dec 2013 Flood up
- 90% scenario – 6A and B would be tidal

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