

SOUTH BAY SALT POND RESTORATION PROJECT

Bird Workshop 2 Synopsis: Modeling to predict bird response to habitat change

Date Held: May 23, 2005, 10:00am - 4:00pm

Purpose: To discuss the state of our knowledge on migratory bird use of existing habitats in the South Bay, to examine the extent to which restoration is likely to affect bird species currently using salt ponds, to discuss the best ways to model habitat change and bird response, and to determine how we might design or manage the restoration sites to maximize habitat value for all bird species associated with Bay habitats.

Goals of this Workshop:

- Continue learning about the Tidal Marsh Species Recovery Plan;
- To discuss predictive modeling of migratory bird response to habitat change;
- To consider how future model development for the Restoration Project can build on the modeling work of PRBO.

Expected outcomes:

1. Understand the structure, assumptions and predictions of the PRBO model for assessing bird response to habitat change;
2. Learn about the structure, assumptions, predictions of other modeling efforts;
3. Develop a list of indicator species and parameters to assess change in bird species, to validate models, and to prepare for adaptive management;
4. Develop a list of needs/ideas for how future model development can build on the PRBO work to increase predictive power.

Presentation 1: PVA for Clapper Rails for the Tidal Marsh Species Recovery Plan—
Stuart Weiss, ecological consultant

\$ Clapper rails are tidal marsh specialists; they need well-developed channels and plant cover, especially *Grindillia*, for high tide refugia. We need to control non-native mammal predation, such as red fox and mink (an emerging problem).

\$ Birds have high fecundity with about 7 eggs/clutch; 2.4 young/nesting attempt; adult survival is a key population parameter; red fox control, which helped adult survival, was key to saving the species in the South Bay.

\$ Total number now: 1500? South Bay core populations—Greco, Palo Alto, Dunbarton/Mowry

\$ Densities run between 0.5-2 rails/ha at Muzzi, but 0.01-0.08 rails/ha at Bair Island.

\$ Predator management plan target was to have 1.2 rails/ha.

\$ Median winter population from Joy Albertson is 0.23 rails/ha; good rail habitat has between 0.6 - 1.06 rails/ha.

\$ A complete rail database is being developed to improve the modeling effort.

\$ Stuart's model evaluated the mean time to extinction of various population sizes given different estimates of population variance that include all environmental stochasticity. The goal is to achieve times to extinction between 1000-2000 years.

- \$ Variance is about 0.26 for the South Bay birds in winter. Sampling error is subsumed in the variance, which results in a conservative time to extinction.
- \$ A core population should have 500 birds and population growth is the key to high times to extinction. If the population grows at 0.1/yr, then the time to extinction if the initial population is 300, is about 2000 years.
- \$ Need a carrying capacity of >500 birds or >500 ha of high quality marsh; this may decrease variance; predator management is the most important thing to reduce the variance, because it reduces adult mortality.
- \$ We will need to spread the risk to the population among larger subpopulations.
- \$ Each of the three complexes in the Project should support a core population of 500+ birds.

Questions:

- \$ Q: Why the difference between North and South Bay densities? A: In North Bay, densities are probably lower due to lack of predator control and greater areas of lower salinity habitats.
- \$ Comment: Dispersal between populations needs to be included.
- \$ Q: Analysis was year to year in Joy's sampling units. Are there any trends? A: Not right now; not a long-enough data set.

Presentation 2: Modeling the Effects of Restoration on South San Francisco Bay Bird Communities—Diana Stralberg, PRBO

- \$ Diana presented PRBO's modeling approach to determining bird response to habitat change, which is designed to look at effects of restoration actions on South Bay birds and identify the need for management to support the current diversity and abundance of migratory birds.
- \$ Three typical modeling approaches are: demographic, energetic, habitat-based. The PRBO model is habitat-based; habitat is assumed to be limiting, and habitats are assumed to be at carrying capacity.
- \$ Diana noted that PRBO's current modeling has improved on their Phase 1 modeling by using focal species and including important seasons, adding in bathymetry, developing densities for microhabitats in tidal marsh, including intertidal mudflats, overall bird biomass, AIC model averaging and evaluating realistic estimates of restored marshes from PWA model outputs.
- \$ The mudflat portion of the Restoration Project Area is divided into units derived from PRBO's mid-1980s to early 1990s Pacific Flyway surveys for analysis.
- \$ Data for the model come from PRBO's 1999-2001 winter area surveys and 1980-1990s Pacific Flyway surveys and the USGS monitoring data for the Restoration Project area from 2004-2005.
- \$ PRBO has developed a long list of focal species with densities in different habitat types.
- \$ Carrying capacity estimate—use 90th percentile for most birds seen on a particular pond.
- \$ The model will evaluate the relative change from “baseline” to assess performance of the alternatives. Diana says baseline is the number of birds under ISP management.

\$ There are no results from the model yet.

Questions:

\$ Q: How will we determine what the carrying capacity is and how many birds can be accommodated? A: Using the 90th percentile and information on important habitat characteristics.

\$ Q: Are there any independent data to estimate carrying capacity such as prey base? A: No, doesn't seem so. John says JV study of energetics did not work. But, Chris says this may be because other factors are limiting.

\$ Q: How does this population trend approach differ from an index? A: It is relatively similar to a population estimate and point counts can be converted to a density estimate. Detectability may be a source of error. It might be that scaling up to habitats makes this more of an index.

\$ Q: What other model evaluation has been done to assess whether the AIC models are really good ones or not? A: PRBO is in the process of doing this by looking at the standard error around the means. Glenn suggests using a Monte Carlo analysis to better encompass the actual variation.

\$ Q: How has adding the bathymetry data assisted in the model prediction? A: It's helped with the predictive ability of the models.

Presentation 3: Managing Endangered Species in Hawaii–

Chris Elphick, University of Connecticut

\$ Need to manage for multiple species in the same area. How do we balance these species needs through management? All are endangered species.

\$ Three Qs to address:

1. Within a wetland, how many of each species will nest there? Assumes habitat as the limiting factor, but it may not be.
2. What modifications could be made to increase species numbers?
3. What is the optimal design if starting from scratch?

\$ Species information that is fixed in their MESH model, such as breeding territory size, salinity tolerance, etc.

\$ Site information varies by site and is entered by the user: number of ponds, depth, salinity, etc.

\$ The model has a user-friendly interface for managers to use to predict bird numbers.

\$ The model allows for prioritizing some species over others, allows for minimum acceptable goals for species and then maximizing for another, etc.

\$ Model allows for interaction for each species, based on management priorities. Model allows and gives multiple solutions to the problem.

\$ Could ultimately include cost estimates for each solution!

\$ Richard Stillman's model is based on individual-behavior of birds and how they respond to food availability and habitat features. He develops maps of food availability and habitat conditions, which can be used to predict how birds respond to different conditions. It is tied to energetics and then can predict survival rates.

Questions/Comments:

- \$ Comment: Goss-Custard, a leader in avian bird ecology and modeling, will be speaking on models at the Cooper meeting in Arcata in June.
- \$ No spatial structure to ponds and no correlations between habitats.
- \$ Q: How are uncertainties incorporated? A: Not incorporated yet, but will be using a number of runs. And, currently, there are no preliminary data to test the model.
- \$ Q: How could this model be adapted to multiple species? A: That's not difficult, so long as you have enough data on each species. And, it's easy enough to use that managers can run this on a PC.
- \$ Q: How can the "optimization" be done? A: Start by prioritizing and then determining how much you can get for each species. This is a value judgment.

Outcome 1: Comments on the structure of PRBO's model

- \$ All the rail data should also be included in a database that can be used in a model that includes all species, such as rails too.
- \$ GIS-based model evaluation tool is being developed for spatial explicit evaluation. This approach can evaluate the importance of habitat adjacency.
- \$ It's important to note that PRBO model is for feeding, not breeding, numbers.
- \$ Tidal marsh conditions need to be included in the model, too.
- \$ Taking the maximum for the carrying capacity is dangerous, because those numbers may not be sustainable over the long-term.
- \$ Would the answers be different if the ponds were treated collectively and not as discrete units? After all, birds are moving around between ponds and complexes. Summing the data system-wide would be good, but it is missing from this analysis. But, birds in South Bay tend to stay in the same area and not bounce around too much, although they do move if conditions change.
- \$ Really need to look at the carrying capacity for the pond complex, because ponds have different quality. Stuart Weiss faced this with the rails (varying habitat quality) and used the 90th percentile for really good conditions; 75th percentile for a 10-year average and perhaps another percentile for a trigger that's too low.
- \$ Chris' model is designed for managers to use, in part, because the management is not unified. This is a recipe that can be modified by managers. John says we have something like this for managing ponds, but not for birds.
- \$ The model cannot determine the priority of species to maximize. This is set by the project leaders and stakeholders.
- \$ Models are valuable for showing you what not to do.
- \$ How will we evaluate "success" for the rail and especially the saltmarsh harvest mouse?
- \$ Adaptive management experiments can be used to validate PRBO models, so there needs to be coordination there.
- \$ Also, need to plan for marsh restoration variability and different timescales of marsh evolution.

\$ Use a power analysis of current data to determine the best species to use to detect change in a BACI type format. The log nature of populations needs to be considered.

Presentation 4: Summary of USGS Monitoring—John Takekawa, USGS

\$ Monitoring is essential, but the correct parameters need to be measured for the best use of funds to tell us what we need to know about achieving the Project Objectives.

\$ Started monitoring in salt ponds in 1998 and started working for the Project in 2002.

\$ The monitoring for initial transfer actions, interim management and the long-term restoration need to be integrated.

\$ What aspects of the monitoring should be continued through the planning process and what should be continued for long-term restoration monitoring.

\$ Navisound Echo Sounder worked well for providing bottom contour mapping and could be used to assess sediment deposition.

\$ Physical and fish sampling is important.

\$ SPOOM model for pond from Dave Schoellhamer, which will be completed this summer.

\$ Spline analysis indicates that fewer samples of all ponds (bimonthly) could be used to estimate bird numbers.

\$ By 2005, 75% of ponds were affected by the ISP.

Questions/Comments:

\$ Q: Can just a few ponds be sampled to reflect groups of ponds? A: John says no. Certainly this can't work for month to month, but a moving yearly average might work.

\$ Invertebrates are really lots of work and worth doing, but just a few times per year may be all you can do. John thinks focused studies of invertebrates and how well they survive under different conditions would be valuable.

\$ Stuart again points out that multivariate methods may help in grouping.

Outcome 4: How to build on PRBO model to increase predictive power

\$ Glenn Ford uses a grid model and he feels PRBO is doing a lot of this now. This allows one to extrapolate spatially from current data. Also, want to say more about the context of different ponds, such as number of islands, adjacency to important habitat features, etc.

\$ Use LIDAR data for high tide refugia, say for mice, and also perhaps also for roosting habitat.

\$ Include other factors that determine where birds spend their time, things like behavior, predators, habituation, etc. Habitat-based modeling has problems because the social behavior is not included.

\$ Might have a hierarchical structure to the models to bring in behavioral models, not a linear model.

\$ How can we model changes in Bay habitats and effects on diving ducks? John, says look at zones where diving ducks occur and see if this changes with changes in bathymetry. This requires telemetry. Diving birds are more limited by foraging area and disturbance by boats.

- \$ Are invertebrates essential to predicting bird foraging or are cues like water depth and salinity as good? John says this is hard to determine because there usually isn't enough invert data.
- \$ How could CAGUs be included in the model? PRBO has not included this factor but could try to incorporate this factor. This is an emerging issue.
- \$ How are piscivores included in the modeling? A few species in this guild are included as focal species. Arthur urges that California least terns be included in the modeling and management. Nils notes that Forester's terns are included as a focal species. John has 40 Forester's terns that are radio-collared that will provide data on how piscivores are using ponds and the Bay.
- \$ Use the pre-ISP bird numbers as the baseline against which to measure bird response to restoration project changes.

Invited Experts:

Stuart Weiss, Ecological Consultant
 Glenn Ford, RG Ford Consulting
 Diana Stralberg, PRBO
 Chris Elphick, University of Connecticut
 John Takekawa, USGS

Workshop Attendees:

Eric Dunlavy, City of San Jose	Amy Hutzler, State Coastal Conservancy
Mark Herzog, PRBO	Brenda Buxton, State Coastal Conservancy
Nils Warnock, PRBO	Bruce Herbold, USEPA
Nadav Nur, PRBO	Bill DeJager, Army Corps of Engineers
Alvaro Jaramillo, SFBBO	Scott Terrill, H. T. Harvey and Assoc.
Nicole Athearn, USGS	Steve Rottenborn, H. T. Harvey and Assoc.
Julie Yea, USGS	Caitlin Sweeney, BCDC
John Krause, CDFG	Andree Breaux, RWQCB
Joelle Buffa, USFWS	Arthur Feinstein, Citizens to Complete the Refuge
Lynne Trulio, San Jose State University	Samuel Valdez, PRBO
	Cheryl Strong, SFBBO

Synopsis prepared by L. Trulio, October 25, 2005