Predicting the effects of habitat change on South San Francisco Bay bird communities:

An analysis of bird-habitat relationships and evaluation of potential restoration scenarios

Habitat Conversion Model: Phase One

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Final Report

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EXECUTIVE SUMMARY

The recent acquisition of over 5,000 hectares of salt ponds by state and federal wildlife agencies provides an unprecedented opportunity to restore large areas of contiguous tidal wetlands in South San Francisco Bay. The conversion of existing salt evaporation ponds to vegetated tidal and managed marsh will create valuable new habitat for marsh-dependent bird species such as the federally-listed California Clapper Rail and two California Species of Special Concern, the Tidal Marsh Song Sparrow and the Salt Marsh Common Yellowthroat, greatly increasing those species' chances for long-term population viability.

San Francisco Bay tidal wetlands have a long history of human alteration, including the development of adjacent uplands and seasonal wetlands, dredging of tidal mudflats, and changes in salinity and tidal inundation. As a result, restored tidal wetland landscapes may lack the complexity and heterogeneity of their ancient counterparts. At the same time, many waterbird species have come to depend on commercial salt ponds as a replacement for other natural shallow water habitats that have been greatly reduced since European settlement. These species, including the federally-listed Snowy Plover, which use salt ponds as breeding sites, over-wintering habitat and/or stop-over habitat during migration, are likely to decline in numbers as salt ponds are converted to tidal marsh.

In light of these apparent trade-offs, PRBO has completed the first phase of a long-term effort to evaluate the potential effects of salt pond restoration on San Francisco Bay wetland bird communities. We have used comprehensive, standardized bird survey data from salt pond and tidal marsh habitat to develop models that predict the impact of specific restoration scenarios on South Bay bird diversity and potential numbers (as represented by available habitat). Some of our preliminary findings suggest the following:

- While songbirds and rails could benefit greatly from creation of new tidal marsh habitat, the loss of salt ponds may cause substantial reductions in mean daily waterbird numbers in those areas, especially diving ducks, fish-eaters, and shorebirds. Whether reductions and increases in bird numbers using the restored sites will result in regional changes in bird numbers is still unknown.

- The number of waterbirds that use tidal marsh habitat is strongly affected by the amount of open water habitat in the marsh (i.e., large channels and ponded areas). Thus, when new tidal marshes are created, the design, engineering and long-term management of permanent ponded areas and major sloughs (i.e., extensive open water areas) can mitigate the potential negative impact on waterbirds caused by loss of salt pond habitat. Mean daily dabbling duck numbers may even be increased through the design and management of individual restoration sites.
- Lower salinity salt ponds (< 60 ppt) support the highest number and diversity of species, while high salinity ponds (120-200 ppt) support the highest densities of shorebirds, due to their prey communities and physical characteristics. Thus retaining many low salinity ponds and a few high salinity ponds, as well as the mid-salinity ponds that complete the evaporation chain, would be most beneficial to a large number of species, if the ponds continue to function as they presently do.
- Species diversity and apparent densities can be influenced by landscape context. Increasing the amount of tidal marsh and tidal flats within the South Bay wetland landscape may help promote high species diversity, as well as increased landbird and waterbird numbers, in both salt pond and tidal marsh habitats.
- Maintaining a wetland mosaic that includes tidal marsh habitat in various successional stages, interspersed with salt ponds managed for appropriate depths and salinities, can help preserve and enhance current South Bay bird populations.
- Trade-offs are inevitable. The minimization of waterbird losses also means a smaller gain in tidal marsh landbirds, which can't use large open water habitat areas. But there are also trade-offs among waterbirds in the management of remaining salt ponds, with respect to salinity preferences (generally low for ducks and fish-eaters, high for shorebirds) and depths (low for shorebirds, higher for diving ducks and fish-eaters). Trade-offs should be evaluated in the context of long-term population viability, rather than absolute bird numbers.
- Our findings are based on habitat associations and should not be directly extrapolated to future trajectories of bird populations. Future research should explore the population viability of various species and attempt to identify population bottlenecks and the habitat

features that affect them, as well as the factors affecting carrying capacities of restored habitats (e.g. prey availability, microhabitat characteristics).

- Additional future research should include monitoring all birds throughout the restoration process, with timely evaluations of how bird numbers are changing. Concerted efforts should be made to combine and synthesize our bird modeling exercises with other San Francisco Bay wetlands research (e.g., hydrology, geomorphology, invertebrates, fish).