# New Understanding: The Baylands and Climate Change
# Appendix C: Changes in the Configuration of Baylands Habitats

## METHODS FOR CALCULATING CHANGE

Metrics for patch size and core/edge habitat analysis were chosen to reflect changes in marsh habitat broadly relevant to species of interest, specifically inter-tidal rails. Values from the scientific literature were used to identify ecologically relevant thresholds for patch boundaries. In the GIS, discrete marsh polygons were considered part of the same patch if they were located within 60 m of one another. This distance is based on a rule set for defining intertidal resident rail patches developed by Collins and Grossinger (2004). Marsh polygons were taken from 2009 BAARI data (2011). Core area was defined as areas more that 50m from the patch edge, based on the work of Spautz and Nur (2002), who used a buffer distance of 50 m to define core habitat when they determined that the probability of black rail presence increases significantly with marsh core area. Note that these metrics do not take habitat quality and suitability or population dynamics into account and are meant only to provide a coarse picture of changes in marsh habitat configuration relevant to species of concern.

## FRAGMENTATION OF TIDAL MARSH

The average size of marsh patches in the Bay has declined from historical conditions as large patches have become increasingly fragmented. Smaller patches existed historically in some places; however, the small patches that exist today are mostly remnants of once-larger marshes. Clapper Rails are most likely to be detected in marshes >100 ha (247 acres) in size, and chances of detecting rails diminished proportionately in smaller marshes (Spautz and Nur 2002). There were 31 marsh patches greater than 100 ha in the 2009 Baylands: eight in the South Bay, one in the Central Bay, nine in the North Bay, and thirteen in Suisun. The average size of marsh patches today is 142 acres (with a range of 0.01 to 8,519 acres).

Large marsh patches in the modern Baylands are primarily composed of wide marsh areas connected by narrow fringing marsh. The complex shape of these patches leads to a high proportion of edge habitat relative to the marsh core. Spautz and Nur (2002) found that black rails were more likely to be present in marshes with a large proportion of core area, where "core" was defined as habitat > 50 m from the marsh edge. While long, narrow stretches of marsh may function as corridors that facilitate wildlife movement between wider areas, these fringing marshes are usually alongside levees and susceptible to increased predation, often contain less complex channels, and provide less vegetative cover and structure than wider marshes.

Patterns of marsh fragmentation vary by subregion. The Central Bay has the fewest, smallest, and most isolated marshes, as a result of both watershed topography and urbanization. Smaller, more isolated habitat patches tend to support smaller wildlife populations that are more vulnerable to extirpation and less able to be recolonized compared to populations in larger, more connected patches (Meffe and Carroll 1994, Schonewald-Cox et al. 1983). The only large patch (> 100 ha) in Central Bay is Corte Madera marsh. Arrowhead marsh, on the East Bay shoreline, has the highest clapper rail density of any marsh in the Estuary (Liu et. al. 2009). Unfortunately, its isolation may limit juvenile dispersal and the ability of the marsh to be a population source for distant large marshes.

The North Bay has the greatest amount of marsh habitat (17,461 acres) and the largest average marsh patch size (205 acres). The largest marsh patch is in the North Bay. That patch includes the young marsh on the edge of San Pablo Bay, Pond 2A in the Napa-Sonoma marsh, Carl's marsh, and fringing marshes along sloughs of Napa-Sonoma marsh that connect all the parts of the patch. Petaluma Marsh in the North Bay is the largest remaining ancient marsh in the Estuary.

The South Bay has the second biggest patch and second largest average patch size (172 acres), but less marsh overall than either North Bay or Suisun. The largest patch in the South Bay extends from Newark Slough to Guadalupe Slough, encompassing Dumbarton marsh, Triangle marsh, New Chicago marsh, and the connecting fringing marsh. The South Bay has a greater proportion of edge to core marsh habitat than either the North Bay or Suisun. The two biggest restoration projects in the Bay, the Napa-Sonoma Marsh and the South Bay Salt Pond Restoration projects, are occurring next to and within the two largest existing marsh patches, further increasing their value and hopefully reducing future edge to core habitat ratios.

Suisun has the second greatest extent of tidal marsh (14,433 acres), and third largest average patch size (149 acres). Note that the diked and managed duck clubs dominating the Suisun landscape are not identified as tidal marsh and, therefore, are excluded from this analysis. The smaller average size of marsh patches in Suisun, despite the greater total habitat area, may be due in part due to the discontinuous nature of the fringing marsh. While the channels in the North and South Bays appear to have filled in during the past 200 years, creating miles of fringing marsh, the channels in Suisun Bay have not, for the most part.