California Clapper Rail population trends in the San Francisco Bay Estuary

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Introduction
Over the past 200 years, tidal salt marshes of the San Francisco Bay estuary have been drastically reduced and degraded by human activities. One species affected is the Clapper Rail (Rallus longirostris obsoletus), which is endemic to the estuary, and tidal marsh-dependent. The Clapper Rail is also thought to be highly susceptible to depredation by introduced predators.

Figure 1. Over the past 200 years, tidal salt marshes of the San Francisco Bay estuary have been drastically reduced and degraded by human activities. One species affected is the Clapper Rail (Rallus longirostris obsoletus), which is endemic to the estuary, and tidal marsh-dependent. The Clapper Rail is also thought to be highly susceptible to depredation by introduced predators.

Methods
Censuses were conducted from January through April in 2005. Most marshes were surveyed 2-3 times using a linear transect method, with 30 minutes per site. Some smaller marshes were surveyed once. Clapper Rail vocalizations were recorded with the time, direction and distance from the listening station. If Clapper Rallus longirostris (see Figure 1) had been previously detected at a listening station, tape plays of California Clapper Rail vocalization was utilized to elicit a response. Vocalizations were assumed to be representative of 1-2 rails, except when known to be a single individual or a pair.

Twenty-one marshes were surveyed in both 1992-93 and 2005. Marsh sizes were assumed to have remained static for the purpose of calculating Clapper Rail numbers based on densities calculated using the AAI methodology. The AAI method counted only detections within 100m. A mean based on the minimum and maximum number of Clapper Ralls detected was calculated for each survey. The number of rails was then converted to a density by dividing the mean number of rails by the total marsh area to arrive at an approximate density, by assuming that for each 100m radius area of marsh was surveyed. The average density across the survey points within each marsh was then multiplied by the total marsh area to arrive at an approximate number of Clapper Ralls per marsh.

We selected 18 marshes with vegetation surveys conducted in 2004-05 for further analysis for statistical analysis. Density estimates of Clapper Rail vocalization decreased at 280, so a new set of densities were calculated using densities from 2006. Survey areas were calculated using marsh areas generated by the National Ecosystems Project and by the San Francisco Estuary Institute Bay Area Ecosystems Version 1.0.

RESULTS
Population trends
Analysis of the change in Clapper Rail population between the 1992-93 and 2005 surveys is shown in Figure 1. Clapper Ralls in Central San Francisco Bay increased dramatically at the two marshes comprising the Contra Madera Ecological Reserve, but the small population in Richardson Bay was not detected in 2005.

The trend on the west side of San Pablo Bay was also generally positive, with population increases in the marshes north and south of Petaluma Creek. The small population in the mid- and upper reaches of Gallinas Creek was also still present in 2005. The population at Richardson Creek/Mouth also showed an increase, though the trend was based only on 2 survey points.

The population trend in the western portions of San Pablo Bay and in Suisun Bay is generally negative, as no Clapper Ralls were detected in Suisun Bay in 2005, not at the upper reaches of the Suisun River. The small population at the fragmented marshes north of Pt. Richmond was absent in 2005. The population at White Slough north of Vallejo showed a sharp decline.

Landscape scale habitat associations
Clapper Rail detection showed a negative association with distance from the Golden Gate and degree of isolation from other existing patches (Table 1). Nature Reserve and Island vegetation were negatively associated with Clapper Rails. Positive correlations were found with: vegetation type; the presence of channels; increased development; and increased salinity. No significant relationships were found with: vegetation density and mid-latitude development.

Clapper Rail density was positively related to the presence of Sanguineum and Salicornia. On the other hand, the presence of pickleweed was negatively associated with Clapper Rail density. A higher number of Clapper Ralls was detected in restored marshes.

The traditional description of Clapper Rail breeding range excludes Suisun Bay. It is possible that the rails detected in 1992-93 engaged in a short-term range expansion during a dry period that increased the availability of suitable habitat on the west end and the inner estuary. The 2005 surveys did not comprehensively survey Suisun Bay, so it is possible that there is a small population in the extensive marshes in this area.

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Acknowledgements
We wish to thank the following individuals for their contributions to this study.形 Caption: California Clapper Rail population trends: Northern reaches of SF Bay Estuary.