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MARSH STUDIES IN SOUTH SAN FRANCISCO BAY: 2005 – 2008

CALIFORNIA CLAPPER RAIL AND SALT MARSH HARVEST MOUSE SURVEY WORK PLAN

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1.0 INTRODUCTION

Large-scale plant community changes in the remaining marshes of South San Francisco Bay were first observed in the 1970's. Early studies conducted for the South Bay Dischargers Authority in 1984 confirmed those habitat changes. In 1989, as part of a monitoring program required by the San Francisco Bay Regional Water Quality Control Board, the City of San Jose commissioned a more detailed study of the marshes potentially affected by the freshwater discharge from the Water Pollution Control Plant (WPCP). Subsequent mapping studies were conducted in 1991, 1994, and annually thereafter. These studies documented changes in the distribution and aerial extent of salt, brackish and freshwater marsh.

Changes in marsh composition could potentially affect two wildlife species listed as Endangered or Threatened under the Federal Endangered Species Act, the California Clapper Rail (*Rallus longirostris obsoletus*) and the salt marsh harvest mouse (*Reithrodontomys raviventris*). Surveys for these species were conducted in 1990 (H. T. Harvey & Associates 1990a, 1990b). The work plan proposed herein is for the continuation of the WPCP monitoring program to remain in compliance with the City's Regional Water Quality Control Board discharge permit, which states: *In order to provide information on the presence or absence of California clapper rail and salt marsh harvest mouse, the Discharger will conduct a synoptic survey for these species in the year 2006. The Discharger shall submit to the Board, the CDFG, and the USFWS, Sacramento Office, its proposed survey work plan 6 months prior to beginning the survey. The final report shall be included with the annual South Bay Action Plan to be submitted by February 28th, 2007.*

Surveys to be conducted in 2006 will have a level of effort similar to the California Clapper Rail and salt marsh harvest mouse surveys conducted in 1990, and will be performed in the identical locations. The fundamental objectives of these surveys is to provide information on the presence or absence of these species in the Main Study Area, to ascertain how the populations of these species may have changed since 1990, and to re-establish a baseline for further monitoring efforts. These surveys may also suggest whether the changes in salt marsh vegetation that have occurred since 1990 in South San Francisco Bay marshes has influenced longer-term population trends for these two wildlife species. Finally, it is hoped that this survey will further address the question of whether and to what degree brackish, or partially brackish, marshes can provide suitable habitat for the California Clapper Rail and salt marsh harvest mouse.

2.0 CLAPPER RAIL SURVEYS

2.1 BACKGROUND AND POSSIBLE OUTCOMES

Optimal habitat for California Clapper Rail (CCR) comprises tidal salt marsh in San Francisco Bay with direct tidal circulation, an intricate network of tidal sloughs, pickleweed with cordgrass, gumplant, and other high-marsh plants, and abundant and dense high-marsh vegetation for cover during high tides (Albertson and Evans 2000). Brackish marshes are generally not considered to be suitable habitat. The 1990 surveys found that CCR densities were highest on average in those marshes that possessed a vegetation type categorized as transitional between salt marsh and brackish marsh, while densities were lowest in marshes categorized as brackish (Table 1, Figure 1) (H. T. Harvey & Associates 1990a).

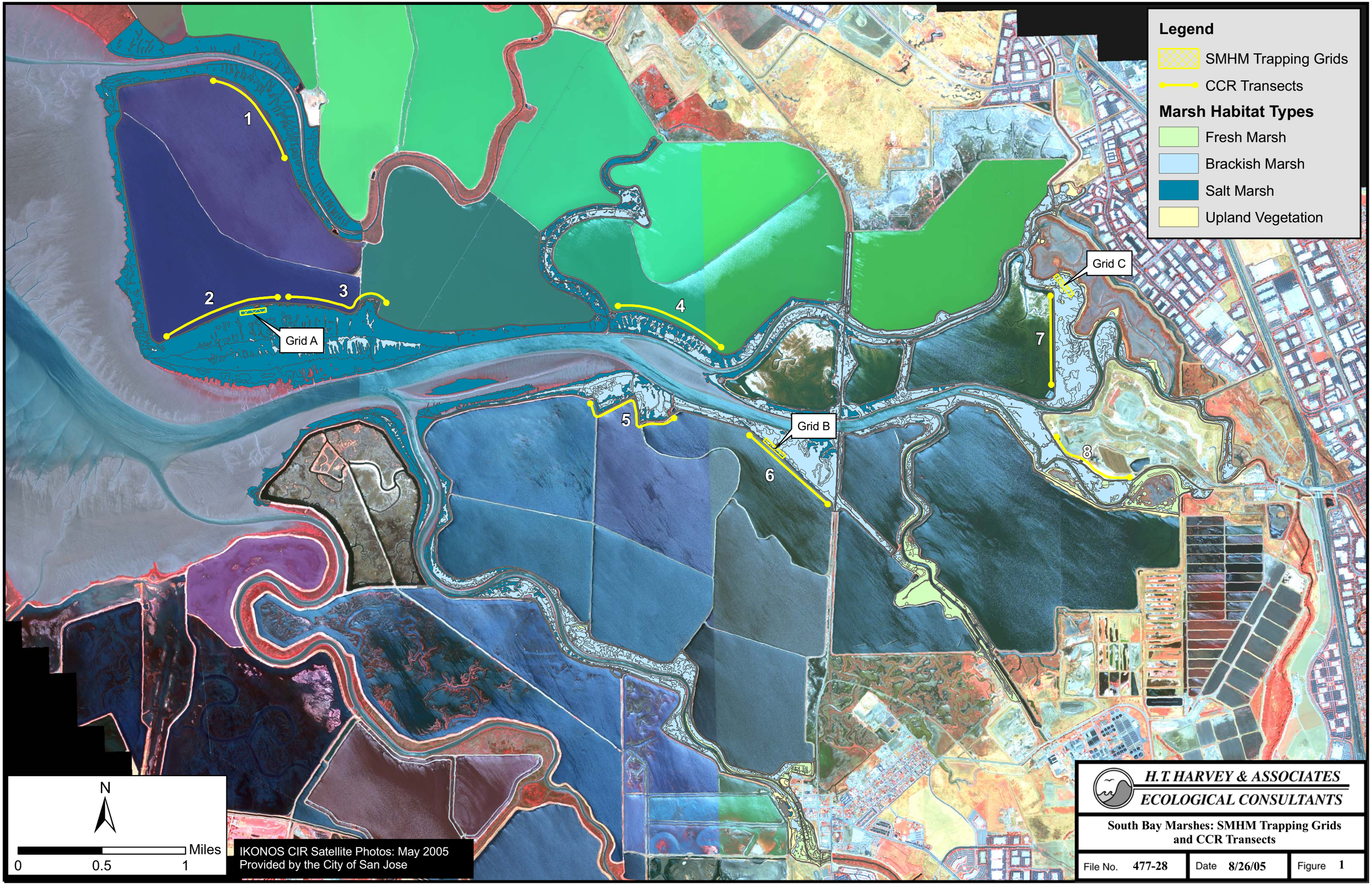
Table 1. California Clapper Rail Survey Sites, Marsh Types, and 1990 Densities

Site no.	Marsh Name	Marsh Type	1990 Rails per Hectare
1	Mowry Slough West	Salt	0.41
2	Calaveras Point East I	Salt	0.27
3	Calaveras Point East II	Salt	0.33
4	Mud Slough West	Transitional	0.49
5	Goose Point Marsh	Transitional	0.57
6	Triangle Marsh	Transitional	0.60
7	Warm Springs Marsh	Brackish	0.18
8	South Coyote Slough	Brackish	0.17

Source: H. T. Harvey & Associates 1990a.

The vegetation in a number of the transitional marshes of South San Francisco Bay has shifted toward greater predominance of species associated with brackish marsh conditions between 1989 and 2004 (H. T. Harvey & Associates 2004). If a decline in CCR densities in these marshes were observed in the 2006 surveys as compared to 1990, this might suggest that the increasingly brackish nature of these marshes has adversely affected the California Clapper Rail. Alternatively, no significant change in CCR densities in the transitional marshes between 1990 and 2006 implies that the changes in vegetation have not negatively impacted rail populations, or that any negative influence of the vegetation change was not detectable in light of the other factors influencing the marshes since 1990. Beginning in 1991, intensive predator-control efforts have been enacted in the marshes of South San Francisco Bay, which had a documented benefit to rail populations (Harding et al. 1998). If an increase in rail densities between 1990 and 2006 is observed, it may be attributable to predator control. The salt marshes of Calaveras Point have significantly increased in total area and plant species diversity since 1990 (H. T. Harvey & Associates 2004), and this improved habitat may account for any observed increases in CCR densities in these particular marshes between 1990 and 2006.

It is important to keep in mind when interpreting the outcomes of this survey that it compares just two points in time, and hence cannot control for inter-annual stochastic variation in rail densities. The methodology in the 2006 survey will be changed somewhat from that used in 1990 to match current USFWS protocol for California Clapper Rail surveys (see methods below)



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South Bay Marshes: SMHM Trapping Grids and CCR Transects

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currently being used to monitor CCR throughout its range (now limited to the San Francisco Bay Estuary system). Based on survey results, it is anticipated that both survey methodologies will yield comparable results (Mark Herzog, Point Reyes Bird Observatory personal communication).

The proposed 2006 survey may also give further insight into whether brackish habitat dominated by alkali bulrush (*Scirpus robustus*) constitutes suitable habitat for California Clapper Rails. While California Clapper Rails have been observed in this habitat, this alone does not necessarily indicate that it can truly support a CCR population (H. T. Harvey & Associates 1990a). It is possible that bulrush stands constitute low-quality "sink" habitat that is only occupied by those rails that cannot obtain a territory in the higher quality "source" habitat of the salt or transitional marshes. California Clapper Rails are quite territorial, and their young are precocial (Albertson and Evans 2000), both characteristics that would tend to result in many young birds having to disperse far from their natal habitat. If these birds are habitat limited, then young and unmated individuals might occupy marginal habitat even though their rates of survival and reproduction are too low there to sustain a population. The presence of successfully mating pairs in optimal habitat and juvenile, unmated or unsuccessfully mated individuals in surrounding marginal habitat is a population structure associated with a source-sink dynamic for a habitat-limited population (Pulliam 1998). This survey will indicate whether any California Clapper Rails found in bulrush-dominated brackish habitat are breeding pairs or solitary individuals. If the brackish marshes contain a ratio of breeding pairs to unmated individuals similar to that of the transitional and salt marshes, this would imply that the bulrush dominated brackish marshes may be suitable habitat. Alternatively, a greater preponderance of unmated individuals versus breeding pairs in the brackish marsh habitat implies that this is marginal habitat for California Clapper Rails. In order to decisively conclude whether brackish marshes constitute sink habitat for Clapper Rails, the survival and reproduction of individual birds in the various marsh types would need to be measured (*e.g.*, Breininger and Carter 2002), which is beyond the scope of this study. However, the data on spatial population structure gained in this study may potentially give some indication as to whether brackish, bulrush-dominated marshes constitute marginal "sink" habitat or suitable "source" habitat for CCR.

2.2 CLAPPER RAIL SURVEY METHODS

Two general types of surveys, winter surveys and spring breeding season surveys, have been conducted to estimate numbers of California Clapper Rails (CCR) in the San Francisco Bay. The USFWS and the CDFG typically conduct annual winter surveys from airboats at extreme high tides (*e.g.*, Foerster 1989). Breeding season surveys are based on listening for calling pairs and individuals. We propose to conduct breeding season surveys similar to those conducted in 1990 (H. T. Harvey & Associates 1990a). These surveys will utilize the same methodology as does the Point Reyes Bird Observatory (PRBO), which began baywide CCR surveys in 2005 and plans to conduct CCR surveys in 2006 at locations throughout San Francisco Bay. In 2005, PRBO surveyed two locations in the South Bay; along Mowry Slough and near Newby Island. PRBO has not yet determined their survey locations for 2006, but our proposed locations surveys could be adjusted to prevent any duplication of effort and gather useful information from another marsh segment. We will coordinate with PRBO prior to the 2006 surveys.

While the use of a different survey technique may lessen comparability with the 1990 surveys (this comparability could be empirically addressed in a subsequent study), it increases

comparability with California Clapper Rail density data found in other marshes in the San Francisco Bay by PRBO. Furthermore, this methodology is consistent with current USFWS survey protocol for CCR, whereas the 1990 method is not.

The breeding season surveys will be conducted at eight marsh locations which were previously surveyed in 1990, and which represent a range of vegetation types from salt to transitional to brackish. Surveys will be conducted from levees adjacent to marshes. Survey methods will vary somewhat for marshes with high rail densities (sites 1-3) as compared to marshes with low to medium rail densities (sites 4-8).

Marshes with low to medium CCR densities (sites 4-8) will be surveyed along transects partitioned with listening stations at 200-meter intervals. These marshes will be surveyed with 10-minute passive listening sessions at each station along a transect on three separate days. If these three passive surveys do not detect any rails, a fourth survey will be performed that utilizes rail call playback. Playback will be conducted as follows: 5 minutes passive listening, then 1-minute of call playback, and finally 4 minutes of passive listening. Playback will be stopped immediately when a CCR is heard and not played again during the survey at that listening station. If a CCR is heard during the initial 5-minute listening period at a station, then call playback will not be utilized at all. After performing the call playback, observers will then move to the next station and repeat the process. Playback will not be used at stations immediately adjacent to a station where a CCR was just heard within ~200m of the observer, which effectively means that the surveyor skips playback at stations adjacent to where rails were just heard. Tape playbacks will be standardized for content and volume across sites, and will be broadcast toward all marsh habitat at a station. The tape or CD recording will include a combination of clapper and duet calls. The recording will include at least 4 complete calls with at least 5 seconds of silence between the calls. Volume will be between 80-90dB, as measured 1 meter in front of the speaker. Taped calls will be used according to and consistent with the terms and conditions of a valid section 10(a)(1)(A) permit (i.e., only by individuals with a valid permit).

Marshes with high CCR densities (sites 1-3) will be surveyed from stationary listening positions. Observers will be present at each listening station for the entire 1.5-hour survey period. Stations will be placed at 200-meter intervals along a transect. High-density marshes will be surveyed passively on two separate days. If rails are detected during these two surveys, a third passive survey will be performed. If rails have not been detected on the previous days, call playback will be utilized on the third survey. Playback for stationary surveys will be conducted as follows: 5 minutes passive listening, then 1-minute of call playback, and finally 4 minutes of passive listening. There will be 9 minutes of passive listening between each 1 minute of playback, and this 10 minute routine will be repeated until the end of the 1.5 hour survey period or until a rail is heard. Playback will be stopped immediately when a CCR is heard and not played again during the survey at that listening station. Because the survey methodology required by the USFWS differs between marshes with high and low/medium densities of CCR, and one of the objectives of this survey is to compare the densities in brackish vs. salt marsh habitats, the data collected during the first 10 minutes of each survey on the high-density sites will be recorded separately from data during the remainder of the survey. This will allow both for the analysis of data

according to the USFWS protocol (for the entire 1.5-hour survey period) and for a means of analyzing data so as to compare equal-effort surveys from brackish and salt marsh transects.

For all marshes, the length of a transect is set to the entire length of the marsh being surveyed, or to the maximum length that can be surveyed during the census time window, whichever is shorter. Transect length thereby varies among the eight sample sites, and is expected to average approximately 1000 meters and range between 800 and 1200 meters. Listening stations will be spaced no more than 200 meters apart.

California Clapper Rail call types noted in the surveys will follow Massey and Zembal (1987) and included the *clapper*, which is characteristic of a bird of either sex; the *duet* (alternating clapper calls), designating a mated pair; the *kek*, usually from an unmated male; and the *kek-burr*, usually from an unmated female. CCR density will be determined for each marsh section as minimum population per hectare. As originally determined in the 1990 study, a summary of total individuals located in each marsh will be expressed as number of pairs, number of unmated males, number of unmated females, and number of those with unknown sex in table format. Locations of rails within a marsh will be plotted on a map during the survey.

2.3 CLAPPER RAIL SURVEY LOCATIONS

The eight marshes to be surveyed in 2006 (Mowry Slough West, Calaveras Point East I and II, Mud Slough West, Goose Point Marsh, Triangle Marsh, Warm Springs Marsh and South Coyote Slough) constitute a subset of the thirteen marshes surveyed in 1990. Warm Springs Marsh and South Coyote Slough are classified as brackish marshes, Triangle Marsh, Mud Slough West, and Goose Point are classified as transitional marshes, and Mowry Slough West and Calaveras Point East I and II are classified as salt marshes (Table 1, Figure 1).

Change in the vegetation of many of these survey sites between 1990 and the present has been documented (H. T. Harvey & Associates 2004). In the brackish marshes, Warm Springs Marsh has shown an increase in the presence of invasive perennial pepperweed (*Lepidium latifolium),* while the vegetation of South Coyote Slough Marsh is largely unchanged. The three transitional marshes, Mud Slough West, Goose Point Marsh, and Triangle Marsh, have all seen vegetation shifts toward more brackish rather than salt associated species, but are still categorized as transitional. In the salt marshes, Mowry Slough West currently has a greater diversity of salt marsh plant species than in 1990, and thereby greater spatial habitat complexity. Due to natural sedimentation, the marsh plains at the Calaveras Point East (I and II) sites have significantly increased in area, and the salt marsh vegetation at these sites has also increased in species diversity and spatial complexity.

2.4 CLAPPER RAIL SURVEY TIMING

Surveys will be conducted between January 15 and April 15, and at least one survey at each site will be performed in the month of March. Because the optimal calling period is mid-January through March, every effort will be made to complete the surveys prior to the end of March. However, because of the season in which surveys will be performed, rain may prohibit surveys on many dates due to the inability of surveyors to drive on salt-pond levees within 72 hours of rain and due to restrictions on the performance of surveys when rain and wind hamper the

detectability of rails. In addition, the USFWS requirement for an additional survey at each station (i.e., three surveys in high-density marshes and four in low/medium-density marshes), as compared to 2005 survey protocols, necessitates additional survey dates that were not previously planned. As a result, it may be necessary to extend the survey period into April to allow for an adequate number of surveys at each station.

Each site will be surveyed on three or four separate days at dawn and dusk. Morning surveys will last from no more than one hour before sunrise to no more than one and one half hours after, and evening surveys will last from one hour before sunset to no more than one hour after. At least one week will pass between successive surveys at any given location. Transects will be started at opposite ends on alternating surveys to remove bias associated with sampling the same point at the same time of day. Surveys will not be conducted under heavy rain conditions, and heavy wind conditions (> 10 mph) will be avoided if possible. Surveys will be conducted at tides in which tidal sloughs are no more than bank full, and high (flood) tides will be avoided. Tape playback surveys will not be conducted during full moon conditions to prevent an increase in the likelihood of predation. Tide height, wind speed, moon phase and weather conditions will be noted for each survey.

3.0 SALT MARSH HARVEST MOUSE SURVEYS

3.1 BACKGROUND AND POSSIBLE OUTCOMES

The preferred habitat of the salt marsh harvest mouse (SMHM) is the middle and high zones of tidal salt marshes, which are predominantly pickleweed (*Salicornia virginica*) (Shellhammer, 1982). The SMHM is dependent upon dense perennial salt marsh vegetation for both food and cover. The 2006 SMHM surveys will utilize the identical methodology and survey sites as the 1990 survey, making these results directly comparable. This should give an indication of the longer-term population trends of the SMHM in these marshes. The 1990 surveys were performed in three marshes, one brackish, one transitional, and one salt. As with the California Clapper Rail habitat, the transitional marsh in this survey currently has an increased predominance of brackish marsh vegetation as compared to 1990. Comparing the 1990 and 2006 densities in this marsh may suggest whether this shift in vegetation has affected the salt marsh harvest mouse population. Just as with the CCR surveys, this study compares just two points in time, and hence cannot control for inter-annual stochastic variation in SMHM densities.

Table 2. Salt Marsh Harvest Mouse Survey Sites, Marsh Types, and 1990 Results

Site	Marsh Name	Marsh Type	1990 no. individual SMHM trapped per plot (1 ha)
A	Calaveras Point East	Salt	22
B	Triangle Marsh	Transitional	10
C	Warm Springs Marsh	Brackish	0

This study is also a preliminary attempt to address to what degree brackish marsh vegetation, such as alkali bulrush (*Scirpus robustus*), can provide suitable habitat for salt marsh harvest mouse. Generally speaking, bulrush and brackish marshes are not considered suitable habitat for SMHM, and the 1990 survey data are consistent with this (Table 2). However, CDFG and DWR have recently performed trapping surveys at times of tidal coverage with traps placed well up the marsh vegetation, and showed the presence of the North Bay subspecies of the SMHM (*R. r. halocoites*) in brackish vegetation. These surveys differ from almost all previous surveys, in which traps were placed on the ground and were performed at low tide. In addition, the 1990 survey found that in the transitional Triangle Marsh, SMHM were found more often in those pickleweed patches in closer proximity to bulrush patches. These studies suggest that brackish, bulrush-dominated habitat may be of some utility to SMHM, perhaps by providing cover from predators during high tide when the mice must vacate the lower marsh plain. It is suspected that exposure to predators while escaping high tides in areas with insufficient vegetative cover is a major source of mortality for the salt marsh harvest mouse (Fisler, 1965).

This survey will attempt to ascertain whether brackish, bulrush-dominated habitat is utilized by SMHM to a higher degree than previously believed. This will be accomplished by resurveying the two sites that contain a high degree of bulrush, Triangle Marsh and Warm Springs Marsh, during moderate tides with traps placed up in the vegetation, in addition to surveying them at low tide when the traps will be placed on the ground. This supplemental trapping will indicate whether more SHMH can be found in bulrush stands as well as on the soil surface as typical low

tide ground-level surveys have indicated, and may suggest whether the mice use the bulrush as cover for escaping high tides. If bulrush stands are used by SMHM, it is likely that this utility is a function of the proximity and relative cover of the bulrush stands to pickleweed. This survey is designed to preliminarily address questions regarding the percent cover and patch size of bulrush relative to pickleweed that provides useful habitat to SMHM. A more detailed, follow-up study that would survey for SHMH in a wider range of marsh types could give a much more accurate depiction of the mixture of brackish and salt marsh that might provide suitable habitat for the salt marsh harvest mouse.

3.2 SALT MARSH HARVEST MOUSE SURVEY METHODS

Surveys will occur in the three marshes of the South San Francisco Bay that were used as the study sites for the 1990 progress report (H. T. Harvey & Associates 1990b): Calaveras Point, Triangle Marsh, and Warm Springs Marsh (Table 2, Fig 1). While both levee trapping and marsh-plain trapping were conducted in 1990, we believe that repeating the marsh plain trapping would be of the most value. Overall, protocol will be identical to that identified in the 1990 progress report. Dr. Howard Shellhammer has conducted numerous field investigations of the salt marsh harvest mouse, was an author of the 1990 progress report, and will continue to be the senior mammalogist for this survey.

The three ground-level surveys will be placed at essentially the same locations as the 1990 study. At each marsh the survey consists of four-day trapping regimes when tides will not inundate the traps. The trapping regime will consist of placing 100 traps in a grid pattern adjacent to the levees on the marsh plain for four consecutive nights. The grid pattern on the marsh plain is a rectangle of 4 x 25 traps placed 10 m apart. The area of deployment for a grid, or trap line, within each marsh will be located on a map using GPS technology. The traps will be Sherman live-traps deployed in the evening within 60 minutes of sundown, as required by our federal permit and state MOU, and checked before sunrise each morning (traps will be removed during the day). All traps will be baited and provided with nesting material as well as covered to reduce heat loss and overall exposure. Trapped animals are identified, uniquely marked by fur clipping, weighed, sexed, and their locations recorded. The vegetation will be characterized by measuring percent cover and height at every other trap location and at each capture site. Vegetation characteristics will be summarized for capture sites to compare with the 1990 progress report. A summary of trapped animals as well as trapping efficiency will be produced to compare to results from 1990.

The survey higher in the vegetation will be carried out in the same grids as the ground-level study Triangle and Warm Springs Marshes. They will be performed on evenings where the ground will be inundated with water during moderate high tides, as soon as is feasible after the initial ground-level surveys. Because these supplemental surveys are done soon after the initial surveys and in the in the same locations, they can legitimately be directly compared. It may even be possible to track the habitat use of individual animals between the two surveys. CDFG's technique for placing the traps higher up the vegetation will be utilized. In all other respects the trapping regime will be the same as for the ground-level surveys.

One of the objectives of this survey is to give some indication of whether and to what degree brackish marsh vegetation may provide suitable habitat for the salt marsh harvest mouse. The

utility of a stand of bulrush to a salt marsh harvest mouse is likely a function of its proximity to a patch of pickleweed, and the relative proportion of the two types of vegetation within the animal's home range. There may exist some proportion and patch size of bulrush relative to pickleweed that supports high densities of SMHM, and hence could perhaps be considered suitable habitat for SMHM. This study will make a preliminary attempt to approximate this by correlating SMHM densities to vegetation characteristics for the three ground-level surveys. This analysis will be done at three spatial scales, the microhabitat scale (0.1 ha), the home range habitat scale (0.5 ha), and the regional habitat scale (5 ha) (*e.g.* Saab 1998). Some indication of the relationship between SMHM densities and the relative cover and patchiness of bulrush to pickleweed should emerge from this analysis. A more precise relationship could be derived if a greater number and wider range of marshes were surveyed, and could perhaps have management utility.

3.3 SURVEY OF SALT MARSH HARVEST MOUSE LOCATIONS

Survey sites are essentially identical to those of 1990, and include Calaveras Point, Triangle Marsh, and Warm Springs Marsh. The predominately pickleweed marshes at Calaveras Point produced a high capture rate of salt marsh harvest mice in 1990. The salt marshes of Calaveras Point have significantly increased in total area due to natural sedimentation since 1990, and plant species diversity has increased as well (H. T. Harvey & Associates 2004). Triangle Marsh is a transitional marsh in which the vegetation has shifted to contain a lower percent cover of halophytic species and a greater percent cover of brackish marsh species between 1990 and the present. Warm Springs is a brackish marsh which shown an increase in the presence of invasive perennial pepperweed between 1990 and the present.

3.4 TIMING OF SALT MARSH HARVEST MOUSE SURVEY

Surveys will be performed during August 2006, after the breeding season for SMHM. The three ground-level surveys will all be performed on the same nights by three separate teams of trappers. The survey will be scheduled during a 4-day window of low nighttime tides during the month, to prevent trap inundation. Tide charts indicate August 28 through 31 as a potential window for these surveys. However, tidal conditions at the survey locations will be ground-truthed closer to the date of survey, and if necessary, the timing will be adjusted.

The two supplemental surveys will be performed during a 4-night window when the high tide covers the marshes at night with a moderate amount of water. Tide charts indicate September 19 through 22 to be dates when these conditions will exist. It is even more crucial that tidal conditions be ground-truthed for these surveys, so that traps are not inadvertently inundated by an especially high tide. These two surveys will be performed on the same night by two teams of trappers, and will follow the other surveys by approximately 2 weeks.

4.0 WORK PRODUCTS

Reports of the results of the CCR and SMHM surveys will include the following sections: executive summary, introduction, description of all methodology including survey techniques, QA/QC documentation, results, discussion and conclusions, and printed hard-copy maps of the survey areas and animal locations. The data and findings will be presented in tables by survey area and animal species and summarized graphically and spatially in GIS format (ArcGIS 9 Personal Geodatabase).

Although one of the objectives of the current survey is to compare the densities of CCR in brackish vs. salt marsh habitats, the survey methodology required by the USFWS differs between marshes with high and low/medium densities of CCR. For the purposes of reporting results to the USFWS, data from the entire 1.5-hour survey period will be analyzed for each survey station in high-density marshes. However, for the City's purposes, the survey effort used to compare densities in high- and low/medium-density marshes will be equalized to allow a valid, equal-effort comparison. Data from the first 10 minutes for each of the three surveys at the high-density stations will be compared with data from three surveys (randomly selected from the four surveys conducted per station) at each of the low/medium-density stations.

A draft report will be submitted to the City of San Jose for their review in early November 2006, and the report will be finalized and submitted to the agencies by December 31, 2006.

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