2012

Clapper Rail Surveys for the San Francisco Estuary Invasive Spartina Project

Coastal Conservancy

California Clapper Rail Surveys for the San Francisco Estuary Invasive *Spartina* Project 2012

Prepared by:

Jen McBroom
Olofson Environmental, Inc.
2612-A 8th Street
Berkeley, CA 94710
Contact: jtmcbroom@*spartina*.org

For the

State Coastal Conservancy

San Francisco Estuary Invasive *Spartina* Project
1330 Broadway, 13th Floor
Oakland, CA 94612

December 2012

ACKNOWLEDGEMENTS

This report was designed and prepared under the direction of Jen McBroom, the Spartina Project Clapper Rail Monitoring Manager, with considerable hard work by Jen and other OEI biologists and staff, including Jeanne Hammond, Jeffrey Lewis, Jude Stalker, Stephanie Chen, Tobias Rohmer, Tripp McCandlish, and Whitney Thornton. Many thanks to Ingrid Hogle, who compiled and analyzed all *Spartina* data presented here.

We are especially grateful for the support of our partners who shared clapper rail survey data that they collected over the past six years: PRBO Conservation Science, USFWS, East Bay Regional Park District, and Avocet Research and Associates.

Cover photo ©Allen Hirsch, Oakland, California. http://allenh.zenfolio.com/. A California clapper rail (*Rallus longirostris obsoletus*) shakes off water after a swim at Arrowhead Marsh, Oakland, California. The ruffled orange breast feathers indicate that this bird carries a "backpack harness transmitter" secured by two straps encircling the bird's breast. This bird is one of several dozen birds included in a recent study conducted by biologists at U.S. Geological Survey Western Ecological Research Center (http://www.werc.usgs.gov/Project.aspx?ProjectID=152).

This report was prepared for the California Coastal Conservancy's San Francisco Estuary Invasive *Spartina* Project with support and funding from the following contributors:

California Coastal Conservancy

California Wildlife Conservation Board (MOU #99-054-01 and subsequent)

National Oceanic and Atmospheric Administration through the American Reinvestment and Recovery Act (Federal Grant #NA09NMF4630318)

United Stated Fish and Wildlife Service, Southwest Region (Contract #F12PX00504)

Table of Contents

Table of Figures

Table of Tables

1. INTRODUCTION

The Invasive *Spartina* Project (ISP) is a coordinated regional effort to eliminate introduced species of *Spartina* (cordgrass) from the San Francisco Bay Estuary. To achieve this goal, the ISP requires information on the population of endangered California clapper rail (*Rallus longirostris obsoletus*) in the marshes affected by the non-native cordgrass invasion. Annual breeding-season surveys provide a standardized measure of clapper rail presence and distribution in marshes throughout the Estuary. This information guides the ISP in the planning, permitting, and implementation of treatment strategies and helps to minimize the impacts of *Spartina* control on rail populations.

In collaboration with other organizations (including PRBO, USFWS, and EBRPD), Olofson Environmental, Inc (OEI) conducted California clapper rail surveys to inform the ISP about rail populations at sites slated for *Spartina* treatment. Trained and permitted ISP biologists performed standard-protocol surveys at 146 *Spartina*-invaded sites between January 15 and April 15, 2012. The data were gathered in a geodatabase for analysis and summarized on a site-by-site basis. This report describes the geographic scope of the study, outlines the methods used to collect and analyze the data, and presents the results of ISP surveys for the 2012 season, as well as the 2011, 2010 and 2009 seasons where available. We also calculated the cover of non-native *Spartina* at each site from 2008 to 2011 to show the change in non-native *Spartina* on the available habitat over the past four years.

Additionally, in 2012 OEI participated in a pilot program to evaluate the National Marsh Bird Monitoring Protocol (Conway, 2011). A subset of ISP sites was surveyed using both the SF Bay passive survey method (Protocol A) and a modified protocol using the national survey method in order to compare the two methods of survey. A brief summary of our pilot project survey results are included in this report.

2. STUDY AREA

The clapper rail biologists at OEI assessed 146 *Spartina*-invaded sites within nine regions of the San Francisco Estuary for the presence of California clapper rail during the 2012 breeding season **(Table 1)**. The study area spanned the counties of Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma and represented a subset of sites slated for non-native *Spartina* treatment in 2012. Site boundaries were defined prior to the start of this study by the ISP Control Program in order to identify regions of *Spartina* invasion to target for treatment. Portions of several ISP sites were not permitted for *Spartina* treatment during the 2011 control season. These sites were split into smaller subsites and are noted in the table below (Table 1).

Twelve sites were also surveyed using the national monitoring protocol (described in detail in Appendix 2). These 12 sites were: Emeryville Crescent West (06b), Rheem Creek Area (22c), MLK New Marsh (17h), Citation Marsh (20d), Cogswell Section B (20n), Old Alameda Creek (13b), Dubmarton/Audubon (05b), Newark Slough (05c), Alviso Slough (15a.4), Belmont Slough Mouth (02a.1), Greco Island South (02h), Ravenswood Slough (02i), and Seal Slough Mouth (19p).

To evaluate broad-scale trends in California clapper rail survey results, sites were grouped into larger regional boundaries **(Figure 1).** Each region is composed of a varying number of *Spartina* treatment sites and areas of tidal marsh habitat. Nine defined regions are discussed in this report: Bay Bridge North, San Leandro Bay, Hayward, Union City, Dumbarton South (Newark, Mountain View & Alviso subregions combined), San Mateo, San Francisco Peninsula, Marin, and San Pablo Bay (Vallejo and Petaluma subregions combined).

Table 1. Summary table of site information grouped by region. Survey protocols are described in detail in the Methods Section 3.1. Protocol A indicates a passive survey, Protocol C indicates an active survey (broadcast used to elicit response), Protocol B indicates a stationary survey, Protocol F indicates habitat assessment to determine whether surveys are needed, and Protocol N indicates that the site was also evaluated using the national survey method as part of the 2012 pilot protocol study. Survey area and the proportion of site surveyed were calculated assuming a 200 meter detection area around each survey station, though rails were frequently detected beyond this threshold. Survey area was considered null for sites evaluated to be lacking suitable breeding habitat during the initial F-survey site assessment.

REGION: Bay Bridge North						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Emeryville Crescent - East (06a)	C	2	road	21.9	5.9	27%
Emeryville Crescent - West (06b)	A & N	7	road	12.8	12.8	100%
Whittel Marsh (10a)	A	4	footpath	29.9	17.4	58%
Southern Marsh (10b)	A	2	marsh edge	3.1	3.1	100%
Giant Marsh (10c)	C	4	footpath	11.7	11.5	98%
Rheem Creek Area (22c)	A & N	4	footpath	10.0	9.0	89%
Stege Marsh (22d)	A	2	footpath	11.5	6.9	60%
Meeker Slough (22d)	A	2	footpath	9.7	6.9	71%
Hoffman Marsh (22e)	A	3	footpath	14.6	13.6	93%
Richmond/Albany Shoreline (22f)	F - C	4	footpath	5.3	4.4	82%

(Table 1 continued on Page 6)

Figure 1. Regional boundaries of sites surveyed for California Clapper Rail by the Invasive *Spartina* Project in 2012.

Table 1. Summary of site information, continued from Page 4.

REGION: San Leandro Bay						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Elsie Roemer (17a)	A	7	footpath	7.2	7.2	99%
Bay Farm Island (17b)	F	-	-	3.1	-	-
Arrowhead Marsh (17c)	B	1	marsh edge	17.8	6.0	33%
MLK Regional Shoreline and Airport Channel (17d) – site split into five subsites in 2011						
Fan Marsh Shore (17d.1)	A	1	road	1.2	1.2	100%
Airport Channel West (17d.2)	A	5	road	1.9	1.9	100%
East Creek (17d.3)	A	6	footpath	4.6	4.1	90%
Damon Marsh (17d.4)	A	2	footpath	4.3	4.3	100%
Damon to Elmhurst Creek (17d.5)	A	3	footpath	2.6	1.9	73%
San Leandro Creek (17e) – site split into two subsites in 2011						
San Leandro Creek - North (17e.1)	A	3	footpath	0.8	0.8	100%
San Leandro Creek - South (17e.2)	A	4	footpath	2.2	2.2	100%
Oakland Inner Harbor (17f)	F	-	-	20.4	-	-
Coast Guard Is (17g)	F	-	-	1.3	-	-
MLK New Marsh (17h)	A & N	7	footpath	13.9	13.9	100%
Coliseum Channels (17i)	F	-	-	5.4	-	-
Fan Marsh (17j)	A	3	road & levee	5.0	5.0	100%
Airport Channel (17k)	A	1	road	1.6	0.4	25%
Doolittle Pond (17l)	A	2	footpath	1.3	0.8	63%
Alameda Island - East (17m)	A	5	footpath	2.4	1.7	71%

Table 1. Summary of site information, continued from previous page.

REGION: Hayward						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Oro Loma - East (07a)	A	8	old levee	79.7	51.7	65%
Oro Loma - West (07b)	A	16	old levee	52.9	43.0	81%
Oyster Bay Regional Shoreline (20a)	F - C	3	footpath	5.8	2.7	47%
Oakland Golf Links (20b)	F	-	-	0.8	-	-
Dog Bone Marsh (20c)	C	2	footpath	2.8	2.4	83%
Citation Marsh (20d)	A & N	7	levee	45.1	27.6	61%
East Marsh (20e)	A	0	footpath	15.0	4.6	30%
North Marsh (20f)	A	6	footpath	36.0	33.7	94%
Bunker Marsh (20g)	A	4	footpath	14.5	13.7	95%
San Lorenzo Creek & Mouth (20h) – site split into two subsites in 2011						
San Lorenzo Creek & Mouth - North (20h.1)	A	5	marsh edge	3.2	3.1	97%
San Lorenzo Creek & Mouth - South (20h.2)	A	4	marsh edge	10.1	10.0	99%
Bockmann Channel (20i)	C	1	footpath	1.0	0.8	78%
Sulphur Creek (20j)	A	3	footpath	3.3	3.3	100%
Hayward Landing / Shoreline Outliers (20k)	A	1	footpath	2.2	2.1	94%
Johnson's Landing (20l)	A	3	footpath	4.1	3.8	93%
Cogswell - Sec A (20m)	A	7	footpath	14.1	14.1	100%
Cogswell - Sec B (20n)	A & N	7	footpath	40.5	37.3	92%
Cogswell - Sec C (20o)	A	7	footpath	20.1	20.1	100%
Hayward Shoreline Outliers (20p)	F	-	-	1.6	-	-
San Leandro Shoreline Outliers (20q)	F	-	-	4.6	-	-
Oakland Airport (20r)	C	3	road	7.7	5.2	68%
HARD Marsh (20s)	A	5	footpath	26.7	21.3	80%
San Leandro Marina (20t)	F	-	-	3.9	-	-
Estudillo Creek Channel (20u)	F	-	-	5.8	-	-
Hayward Landing Canal (20v)	C	3	footpath	2.5	1.7	69%
Triangle Marsh - Hayward (20w)	A	1	footpath	5.0	4.5	90%

Table 1. Summary of site information, continued from previous page.

Site Name and ID	Survey Protocol	Number of Stations	Station Placement	Site Area (ha)	Survey Area (ha)	Proportion of Site Surveyed
REGION: Union City						
AFCC - Strip Marsh (01e)	F	-	-	6.2	-	-
OAC - North Bank (13a)	A	6	levee	11.1	8.1	73%
OAC - Island (13b)	A & N	9	footpath	37.9	27.1	71%
OAC - South Bank (13c)	A	6	footpath	9.8	8.0	82%
Whale's Tail - North (13d)	A	8	footpath	60.4	26.6	44%
OAC - Upstream 20 Tide Gates (13g)	F - C	3	footpath	9.0	5.5	62%
Eden Landing - North Creek (13h)	F	-	-	14.5	-	-
Eden Landing - Pond 10 (13i)	F	-	-	87.5	-	-
Eden Landing - Mt Eden Creek (13j)	A	6	footpath	50.5	25.0	49%
Eden Landing Reserve - South (13k)	C	4	footpath	96.9	16.2	17%
Eden Landing Reserve - North (13l)	C	4	levee	93.0	32.4	35%
REGION: Dumbarton Bridge South - Newark, Alviso, and Mountain View						
Cooley Landing (16) – site split into two subsites in 2011						
Cooley Landing Central (16.1)	A	4	footpath	16.9	15.4	91%
Cooley Landing East (16.2)	A	4	footpath	55.1	30.3	55%
Ravenswood Open Space Preserve (02j)	C	3	levee	9.6	8.8	92%
Mowry Marsh North (05a.1)	A	8	levee	168.9	32.0	19%
Calaveras Point (05a.2)	A	8	levee	182.9	28.1	15%
Dumbarton/Audubon (05b)	A & N	7	levee	200.4	72.0	36%
Newark Slough (05c)	A & N	7	bay trail	94.0	24.7	26%
Plummer Creek Mitigation (05h)	A	3	footpath	6.7	6.5	97%
Charleston Slough (15a.1)	A	3	levee	14.7	10.7	73%
Mountain View Slough (15a.1)	A	2	levee	28.6	8.3	29%
Stevens Creek to Long Point (15a.2)	C	3	levee	20.7	12.6	61%
Guadalupe Slough (15a.3)	A	8	levee	128.0	35.9	28%
Alviso Slough (15a.4)	A & N	7	levee	167.1	24.8	15%
Coyote Creek South East (15a.5)	A	8	levee	78.7	42.0	53%
Stevens Creek (15c)	C	2	levee	11.3	8.4	75%

Table 1. Summary of site information, continued from previous page.

REGION: San Mateo						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Belmont Slough (02a) – site split into three subsites in 2011						
Belmont Slough Mouth (02a.1)	A & N	6	footpath	27.6	21.1	77%
Belmont Slough South (02a.2)	A	2	footpath	28.1	6.0	21%
Redwood Shores / Bird Island (02a.3)	A	6	footpath	52.2	10.4	20%
Corkscrew Slough (02b)	A	7	footpath	89.1	23.6	44%
Steinberger Slough (02b)	A	6	footpath	33.4	15.8	47%
B2 South Quadrant (02d) – site split into three subsites in 2011						
B2 South Quadrant - North (02d.1)	A	2	levee	24.9	19.1	77%
B2 South Quadrant - South (02d.2)	A	2	levee	23.8	8.3	35%
B2 South Quadrant - East (02d.3)	A	2	levee	27.5	8.1	30%
West Point Slough - NW (02e)	A	1	kayak	2.0	1.9	98%
Greco Island - North (02f)	A	8	boardwalk	201.7	61.0	30%
West Point Slough - SW / E (02g)	A	5	road	16.6	7.0	43%
Greco Island - South (02h)	A & N	6	old levee	93.9	37.3	40%
Ravenswood Slough/Mouth (02i)	A & N	7	footpath	46.5	26.7	57%
Middle Bair N (02k)	A	5	boat	89.6	46.3	52%
Middle Bair SE (02k)	A	3	boat	81.0	26.9	33%
Inner Bair Island Restoration (02l)	C	7	footpath	17.2	17.1	99%
Pond B3 Bair Island Restoration (02m)	F	-	-	166.7	-	-
Foster City (19q)	F	-	-	2.2	-	-
Maple Street Channel (19s)	F	-	-	0.3	-	-

Table 1. Summary of site information, continued from previous page.

REGION: San Francisco Peninsula						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Pier 94 (12a)	F	-	-	1.7	-	-
Pier 98/Heron's Head (12b)	A	2	footpath	4.4	4.1	93%
India Basin (12c)	F	-	-	0.8	-	-
Hunters Point Naval Reserve (12d)	F	-	-	0.5	-	-
Yosemite Channel (12e)	F	-	-	1.3	-	-
Candlestick Cove (12f)	A	1	road	0.7	0.7	100%
Crissy Field (12g)	F	-	-	5.8	-	-
Yerba Buena Island (12h)	F	-	-	4.5	-	-
Mission Creek (12i)	F	-	-	1.2	-	-
Colma Creek (18a)	A	6	footpath	2.8	2.6	91%
Navigable Slough (18b)	A	2	footpath	1.2	1.2	100%
Old Marina (18c)	C	1	footpath	1.9	1.9	98%
Inner Harbor (18d)	C	2	footpath	3.3	3.3	100%
Sam Trans Peninsula (18e)	A	4	footpath	5.8	5.3	92%
Confluence Marsh (18f)	A	0	footpath	2.9	2.9	99%
San Bruno Marsh (18g)	C	6	footpath	11.5	11.1	96%
San Bruno Creek (18h)	C	3	footpath	2.1	1.7	85%
Brisbane Lagoon (19a)	F - C	2	road	4.2	1.9	45%
Sierra Point (19b)	C	2	footpath	1.0	1.0	100%
Oyster Cove (19c)	F - C	2	road	1.2	1.2	100%
Oyster Point Marina (19d)	F	-	-	0.7	-	-
Oyster Point Park (19e)	F	-	-	1.0	-	-
Point San Bruno (19f)	C	1	footpath	1.1	0.9	81%
Seaplane Harbor (19g)	C	2	road	1.7	1.6	97%
SFO (19h)	A	6	road	10.2	6.6	65%
Mills Creek Mouth (19i)	F	-	-	1.1	-	-
Easton Creek Mouth (19j)	F	-	-	2.5	-	-
Sanchez Marsh (19k)	F - C	3	footpath	6.1	6.0	99%
Burlingame Lagoon (19l)	F	-	-	2.2	-	-
Fisherman's Park (19m)	F	-	-	0.5	-	-
Coyote Point Marina (19n)	F	-	-	4.9	-	-
San Mateo Creek (19o)	F	-	-	1.2	-	-
Seal Slough Mouth (19p) – split into two subsites in 2011						
Seal Slough - Central (19p.1)	A & N	3	marsh edge	15.3	13.0	85%
Seal Slough - Periphery (19p.2)	A & N	3	marsh edge	12.5	10.0	80%
Anza Lagoon (19r)	F	-	-	1.8	-	-

Table 1. Summary of site information, continued from previous page.

REGION: Marin						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Pickleweed Park (09)	A	3	footpath	5.7	5.7	100%
Blackie's Creek (03a)	F	-	-	0.2	-	-
Blackie's Creek Mouth (03b)	F	-	-	0.4	-	-
College of Marin (04b)	A	1	footpath	1.8	1.0	56%
Larkspur Ferry Landing Area (04e)	F	-	-	0.4	-	-
Riviera Circle (04f)	F	-	-	1.6	-	-
Creekside Park (04g)	A	4	footpath	8.4	8.4	100%
CMC - Upper (04h)	A	5	footpath	5.5	5.2	94%
CMC - Lower (04i)	C	2	footpath	6.4	2.6	41%
CMC - Mouth (04j) – site split into two subsites in 2011						
CMC Mouth - North Bank (04j.1)	A	2	boardwalk	2.4	2.4	100%
CMC Mouth - South Bank (04j.2)	A	4	boardwalk	4.9	4.9	100%
Murphy Creek (04l)	F	-	-	1.8	-	-
Brickyard Cove (23a)	F - C	5	footpath	17.0	13.0	77%
Beach Drive (23b)	C	2	road	3.5	3.4	96%
Loch Lomond Marina (23c)	F	-	-	1.9	-	-
San Rafael Canal Mouth (23d)	A	2	road	2.7	2.7	100%
Paradise Cay (23f)	F	-	-	9.0	-	-
Greenwood Beach (23g)	C	1	footpath	1.6	1.5	96%
Strawberry Point (23h)	C	5	kayak	5.6	5.6	100%
Strawberry Cove (23i)	C	1	footpath	4.3	3.3	78%
Sausalito (23k)	F - C	3	footpath	2.2	2.2	100%
Starkweather Park (23l)	C	2	road	3.4	3.4	100%
Triangle Marsh - Marin (23n)	A	2	road	7.7	5.9	76%
REGION: San Pablo Bay - Vallejo & Petaluma						
Site Name and ID	**Survey Protocol**	**Number of Stations**	**Station Placement**	**Site Area (ha)**	**Survey Area (ha)**	**Proportion of Site Surveyed**
Petaluma River - Upper (24a)	A	4	footpath	55.9	17.1	31%
San Pablo Bay NWR Shoreline (26b)	C	5	levee	1043.1	19.6	2%

3. METHODS

3.1 Field Methods

California clapper rail surveys were conducted between January 15 and April 15, 2012, using standardized survey protocols approved by the USFWS (**Appendix 1**). Additionally, OEI participated in a pilot study to evaluate the National Marsh Bird Monitoring Protocol (**Appendix 2**). All surveys were conducted by the trained and permitted field biologists at Olofson Environmental Inc: Jeanne Hammond, Jeffrey Lewis, Jen McBroom, Jude Stalker, Stephanie Chen, Tobias Rohmer and Whitney Thornton.

In 2012, we surveyed 146 *Spartina* treatment sites for clapper rails or for clapper rail habitat. Call count surveys were conducted at 109 sites: 73 sites were surveyed using Protocol A, 34 sites were surveyed using Protocol C, and one site was surveyed using Protocol B. The remaining 38 sites were evaluated for the presence of habitat only (F-survey) and were deemed unlikely to be used by breeding clapper rail. Twelve sites that were surveyed using Protocol A were also surveyed using the National Marsh Bird Monitoring Protocol. The types of survey protocols employed by ISP biologists in 2012 are summarized below.

Protocol A: Passive Call Count Survey

Protocol A is the standard survey protocol written by USFWS biologists and used by researchers throughout the San Francisco Estuary. This survey type is used at sites where clapper rails have been observed within the past two years. Typically, survey stations are placed at 200-meter (m) intervals on peripheral paths around the site. The number of survey stations established at each site varied due to site size, configuration, and accessibility. **Table 1** shows the number of survey stations at each site. The locations of the survey stations were entered into a GIS and navigated to in the field using a GPS unit. For consistency and repeatability, all efforts were made to use the same survey station locations that were established during the previous survey seasons (see **Appendix 3** for a complete list of survey stations used in 2012).

Sites were visited at least three times during the season, with at least two weeks between visits. During the first two rounds, a trained observer stood at each point for 10 minutes, recording all rails detected visually or aurally. For each bird or pair of birds detected the observer recorded: (1) the number of birds, (2) the call type, (3) the minute in which the bird/s called, and (4) distance and angle on a pre-printed datasheet. Additionally, the approximate locations of each rail/pair were plotted on a field map of the site. If during the first two rounds, no clapper rails were detected within a 200 meter radius of a survey station, pre-recorded clapper rail vocalizations were broadcasted after the first five minutes of passive survey during round three. Broadcasts were played for no longer than one minute to elicit a response from rails. The standardized pre-recorded vocalizations were provided by U.S. Fish and Wildlife Service and were played from a compact disc or mp3 player with portable speakers. If a clapper rail responded during the broadcast call, the speakers and player were immediately turned off to avoid harassment of rails.

Protocol C: Active Call Count Survey

A modified protocol for clapper rail call count surveys was developed by USFWS and ISP staff to maximize the chances of detecting rails at sites that have a low probability of supporting clapper rails. Protocol C is identical to the standard survey (Protocol A), except that it allows permitted biologists to play pre-recorded rail vocalizations during all three visits to a site. If a rail is detected, the recording must be immediately switched off and cannot be played again within 200 meters of the detection for the remainder of the season.

Sites that are surveyed using Protocol C are typically isolated, small marsh patches which provide marginal or low-quality rail habitat and where clapper rails have not been detected during the prior two years. To determine whether Protocol C is appropriate to use, sites are first evaluated by a clapper rail biologist using Protocol F. However, if a site was surveyed using Protocol C in previous years, it will continue to be surveyed using active call counts until either (1) the site is reevaluated using Protocol F and habitat is determined absent, or (2) a clapper rail is detected, at which point the site will be surveyed using passive surveys (Protocol A).

Protocol B: Stationary Call Count Survey

Protocol B is a stationary call count survey, generally used at high density clapper rail sites. Listening stations are established along a grid or transect, with stations set apart by 200 meters or more. Observers are present at each station for an entire 2-hour survey period. When calls are recorded, the observer must take care to record the exact time and direction, and best estimate of the distance of the call, so that the data can be reconciled with other observers' data. Reconciliation of data from multiple observers must be planned and closely supervised by a scientist with expertise in field data interpretation.

The Protocol B stationary survey is a passive listening survey, and does not include playing of recorded calls. Currently only two sites in the bay are surveyed using Protocol B: Arrowhead Marsh (surveyed by both ISP and EBRPD) and La Riviere (surveyed by DENWR).

Protocol F: Habitat Assessment Survey

This protocol was developed by ISP staff, in association with Jules Evens (ARA) and Joy Albertson (USFWS), to determine whether apparently marginal habitat meets a suggested minimum set of criteria for likely clapper rail use. These criteria include restoration status, salinity, tidal regime, marsh size and configuration, levee configuration, marsh elevation, presence of upper marsh vegetation, degree of non-native *Spartina* invasion, distance from the nearest marsh with known clapper rails, degree of channelization, and amount of open water (ponding). If at least four criteria related to probable clapper rail presence were met, there was sufficient probability that clapper rails were present, and a recommendation was made for further call count surveys, usually Protocol C. If these criteria were not met, the site was assumed to not support clapper rails, and no further clapper rail surveys were recommended. Marginal and low-quality sites are (re)evaluated in this fashion every year.

National Marsh Bird Monitoring Protocol (Pilot Study): Active Call Count Survey for Multiple Species

The National Marsh Bird Monitoring Protocol is the standard survey protocol written by Courtney Conway and used by researchers across North America. The method is designed to maximize the probability of detection of secretive marsh birds by broadcasting

vocalizations of birds likely to occur at the study sites, which included black rail, clapper rail, Virginia rail, sora, and American bittern at our study sites.

Twelve sites were surveyed using the national protocol, with three rounds per site over the course of the season. Each site was surveyed passively (Protocol A) on the preceding day in order to better compare the two methods of survey. During the national protocol survey, each station was visited for a total of ten minutes each, as with the passive protocol survey. However, after five minutes of passive listening at the survey station, a series of vocalizations of five focal species were broadcast into the marsh for the remaining five minutes. Data were entered into a shared database and submitted to PRBO and FWS for analysis. For a complete description of the survey protocol see Appendix 2.

3.2 Data Management

We used ArcEditor 9.3.1 (Environmental Systems Research Institute, Redlands, CA) to create a personal geodatabase to store and manage clapper rail survey data in 2012. The design of the geodatabase was originally based on a preexisting Access database developed by PRBO Conservation Science in 2005, but has been modified to suit the needs of the ISP. All table elements of the Access database were preserved in the geodatabase, along with the spatial components of the data (see **Appendix 4** for complete geodatabase design).

Data were recorded in the field on paper datasheets (**Appendix 5**), on paper field maps, and in our handheld Trimble GeoXT (Trimble, Sunnyvale, CA) GPS units with ArcPad 7.1 mapping software (Environmental Systems Research Institute, Redlands, CA). The GPS units were used both to navigate to our survey stations and to digitally record data in the field. During a survey, stations and site boundaries were updated in ArcPad with current visit information, as well as site descriptions. Each rail observation was recorded on a paper datasheet with time detected, call type, number of rails, distance, confidence interval for estimated distance, and direction to the observed rail. Additionally, each rail was assigned a unique map reference letter or number and the approximate location of each detected rail was recorded on a paper field map allowing for interpretation of repeat detections any individuals/pairs. Compass and rulers were used to accurately plot rails on paper maps. At sites with overlap between other observers, birds were plotted together on a single map to determine which detections were unique. All other bird species observed at the site were recorded at the bottom of the datasheet. Potential predators of clapper rail nests, young, or adults were also noted.

In the office, data were uploaded from the GPS units and checked in to the geodatabase. Each observer maintained his/her own data in the geodatabase during the field season. Data entered into ArcPad in the field were added to the geodatabase and reviewed for quality and accuracy. Additionally, rail observation data that were recorded on a datasheet in the field were entered into the geodatabase. We used the Direction/Length tool in ArcEditor 9.3.1 to enter the direction (in degrees) and distance (in meters) in order to create a line feature, which we called an 'offset'. A point feature, called 'location,' was created at the end of each offset line to represent the location of each unique rail/pair. When a rail was detected from more than one station, the location point feature was moved toward the intersection of the offset lines, to triangulate a more precise position of the observed rail. These point locations are shown as orange circles in the regional maps in the results section of this report (varying shades of orange represent different survey dates/rounds)

At the end of the field season, all data were proofed against original datasheets for accuracy before analysis. For sites requiring multiple concurrent surveyors, the data for each round were re-evaluated to minimize duplicate counting of rail/pairs when detected by multiple surveyors.

3.3 Data Interpretation

Table 2. Clapper rail detection types.

Detection Code	Detection Type	Range in Number of Rails
C	*clatter*	1 - 2
D	duet - simultaneous *clatter* (often representing a pair)	2
K	*kek*	1 - 2
B	*kek-kek-burr*	1 - 2
KH	*kek-hurrah*	1 - 2
AK	*agitated kek*	1 - 2
SQ	*squawk*	1 - 2
CH	*churr*	1 - 2
V	visual	1 - 2

Standard Clapper Rail Survey Data

Each type of detection represented a standardized range of individual clapper rails (**Table 2**). For instance, a clatter, which may represent a single unmated bird or a pair, was recorded as a range of one to two birds. These ranges were summed at the end of each round to estimate the total number of rails detected (represented as a range from the minimum possible rails detected to the maximum possible rails detected). Birds that were detected from more than one station or by more than one observer during a single round were counted only once toward the total range of rails detected. Once all data were summed for each round at each site, we used the round with the highest minimum count to determine the final range of rails detected for each site.

National Marsh Bird Monitoring Protocol (Pilot Study)

Each detection type represented a single rail, with no assumptions about bird pairs. Clapper rail duets were recorded as two separate clatters rather than a pair duetting. In order to compare summed results between the two survey methods, the minimum of the range collected during the standard clapper rail survey should be used. As with the standard clapper rail survey, birds that were detected from more than one station or by more than one observer during a single round were counted only once toward the total number of rails detected.

Percent Cover Non-Native Spartina

Spartina data were collected by the Invasive *Spartina* Project Monitoring Program as part of an annual inventory for non-native *Spartina* populations. ISP field biologists surveyed potential habitat for invasive *Spartina* from May to November each year. The location, extent, and percent cover of non-native *Spartina* were mapped using ArcPad and collected into a geodatabase. We calculated the net area of the non-native *Spartina* (in hectares) mapped each year from 2008 to 2011 within the digitized boundaries of all sites surveyed by ISP in 2012. The percent cover of non-native *Spartina* at the site was expressed as the net area of *Spartina* as a percent of the site area. This calculation better demonstrates the relative effect of non-native *Spartina* on the habitat at the site.

4. 2012 SURVEY RESULTS

A range of 325 to 422 (average 374) California clapper rails were present at 48 sites of the 146 sites surveyed by OEI staff in 2012. No clapper rails were detected in 2012 at the remaining 98 sites, 38 of which were deemed unsuitable to support breeding rails (surveyed using Protocol F only). Detailed survey results from 2012 are included in **Appendix 6**.

Because most sites have been continuously surveyed for the past 4 years, we are able to compare 2012 with results from 2009, 2010, and 2011 (**Table 3**). There has been little change in the overall number of rails detected between 2009 and 2012, though regionally there have been notable increases and declines over the past four years. Losses were greatest at San Leandro Bay and San Francisco Peninsula, which also saw the greatest declines in *Spartina* vegetative cover over those years. Increases in clapper rail detections since 2009 were observed in the Dumbarton and San Mateo Regions, which includes large refuge marshlands.

As of 2011, the relative cover of non-native *Spartina* has been reduced to less than 1% in most regions. Only the San Leandro Bay Region still supported more than 1% cover of non-native *Spartina* in 2011. This is largely due to a phased treatment approach to protect clapper rails dependent upon hybrid *Spartina* for cover at the small isolated marshes of the San Leandro Bay Region.

Table 3. Clapper rail survey results and *Spartina* inventory summary data at all regions for 2009 to 2012. Net cover non-native *Spartina* within site boundaries, rounded to nearest tenth of a percentage. Results from the national marsh bird protocol for the pilot study are excluded here.

Region	# of Sites in 2012	Total Clapper Rail Detections					Average Percent Cover Non-native *Spartina**				
		2009	2010	2011	2012	Trend	2008	2009	2010	2011	Trend
Bay Bridge North[¥ǂ]	10	18 - 24	19 - 24	13 - 18	14 - 18	↘	0.2%	0.4%	0.2%	0.1%	↘
San Leandro Bay	14	95 - 111	79 - 104	59 - 68	53 - 62	↘	14.5%	8.4%	4.2%	2.9%	↘
Hayward	25	52 - 77	57 - 82	69 - 92	55 - 70	→	6.4%	3.3%	0.9%	0.4%	↘
Union City[¥]	11	12 - 13	13 - 19	12 - 18	11 - 12	→	1.0%	0.1%	0.0%	0.0%	↘
Dumbarton South[ǂ]	14	45 - 62	55 - 74	48 - 70	75 - 108	↗	1.0%	0.6%	0.5%	0.2%	↘
San Mateo	16	57 - 80	92 - 110	87 - 129	93 - 120	↗	1.5%	1.4%	0.7%	0.6%	↘
San Francisco Peninsula	34	27 - 36	7 - 11	10 - 15	4 - 6	↘	10.2%	6.0%	1.1%	0.2%	↘
Marin	22	25 - 41	31 - 35	32 - 36	20 - 26	↘	0.9%	1.4%	0.5%	0.1%	↘
San Pablo Bay	2	-	-	-	-	-	0.0%	0.0%	0.0%	0.0%	-
TOTAL	148	331-444	353-459	330-446	325-422	→	4.4%	2.7%	1.0%	0.6%	↘

* Net cover non-native Spartina within site boundaries, rounded to nearest whole percentage

ǂ Gaps in 2009 data were assigned data from 2010 in order to summarize data across years

¥ Gaps in 2010 or 2011 data were assigned the average of 2009 and 2011 or 2012 results in order to summarize data across years

4.1 Bay Bridge North Region

The Bay Bridge North Region is located in Alameda and Contra Costa Counties, extending from the eastern span of the Bay Bridge in Emeryville to Point Pinole north of San Pablo (**Figure 2**). This shoreline is heavily urbanized: the southern half is predominantly commercial, industrial and high-density residential developments; the northern half is lined with single-family residential communities and the largest and oldest oil refinery on the West Coast operated by Chevron Corporation. The northern portion of this region hosts some large remnant tidal marshes, while those in the southern half are small isolated pocket marshes.

The region includes twelve ISP clapper rail sites, ten of which were surveyed by the ISP in 2012 (**Table 4**). ISP was not responsible for surveying the two larger and more densely occupied tidal marshes in this region, Wildcat Marsh and San Pablo Marsh, which were surveyed by PRBO in 2012. Biologists at ISP conducted passive call count surveys (Protocol A) at seven of ten sites and active call count surveys (Protocol C) at three sites. Two sites were also surveyed using the national protocol: Rheem Creek and Emeryville Crescent West.

No clapper rails were detected in Emeryville Crescent West in 2012 during either type of survey (Protocol A or national protocol). This site has had a small but stable population of clapper rails since ISP began surveying the site in 2006. The decline in rail detections may be due to an actual absence of rails from the site or may be due to a failure to detect them at this noisy site. If rails are absent from the site, it seems unlikely that the loss of rails is associated with impacts from *Spartina* treatment, which has been minimal at the site for the past 3 years. Clapper rails were detected at Whittel Marsh (10a) and Giant Marsh (10c) in 2012. It is likely that clapper rails have occupied these sites continually over the past four years, but that we have failed to detect them in years when we surveyed passively (Protocol A).

Table 4. Summary clapper rail and *Spartina* survey results from 2008-2012 at Bay Bridge North Region.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	**2009**	**2010**	**2011**	**2012**	**Trend**	**2008**	**2009**	**2010**	**2011**	**Trend**
Emeryville Crescent - East (06a)	no data	0	0	0	-	0.1%	0.5%	0.2%	0.2%	↗
Emeryville Crescent - West (06b)	6 - 10	8 - 10	4 - 6	0	↘	0.3%	0.2%	0.3%	0.0%	↘
Whittel Marsh (10a)	no data	1 - 2	0	1 - 2	→	0.0%	0.0%	0.0%	0.0%	-
Southern Marsh (10b)	no data	1 - 2	0	0	↘	0.4%	0.2%	1.0%	0.1%	↘
Giant Marsh (10c)	0	0	0	1 - 2	↗	0.1%	0.2%	0.3%	0.0%	↘
Rheem Creek Area (22c)	6	6	6 - 8	9 - 10	↗	0.1%	1.9%	0.3%	0.8%	↗
Meeker Slough (22d)	2	no data	no data	1 - 2	→	0.1%	0.1%	0.1%	0.0%	↘
Stege Marsh (22d)	no data	no data	no data	2	-	0.0%	0.0%	0.0%	0.0%	-
Hoffman Marsh (22e)	no data	no data	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Albany Shoreline (22f)	no data	0	0	0	-	0.5%	0.4%	0.1%	0.2%	↘

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

Figure 2. Map of clapper rail presence and absence in 2012 at ISP sites in the Bay Bridge North Region. Wildcat and San Pablo Marsh were surveyed by PRBO.

4.2 San Leandro Bay Region

The San Leandro Bay Region in Alameda County is bounded by the cities of Oakland, Alameda, and Bay Farm Island (**Figure 4**). The region includes 13 ISP clapper rail sites, all of which were surveyed by the ISP in 2012. It is a highly urbanized tidal bay of invaded strip marshes and several parcels of restored marsh. There is little to no habitat in the transition zone along the upland edge. Instead, the region is surrounded by landfills, highways, and the Oakland Airport. Predators were frequently observed at sites in this region and public pathways were present at all sites, providing easy access for terrestrial predators.

The San Leandro Bay has been heavily impacted by the invasion and subsequent removal of hybrid *Spartina*. This region remains the most heavily invaded area in the entire estuary, mostly due to phased control at densely occupied clapper rail sites. In 2011, *Spartina* cover in the region had decreased by about 61% from 2008. However, hybrid *Spartina* was left untreated at several sites (17c, 17h, and 17j; and portions of 17d, 17e, and 17k) in 2011 due to concern regarding clapper rail declines in the region. MLK New Marsh (17h), the western portion of Arrowhead Marsh (17c), Fan Marsh (17j), and Damon Marsh (17d.4) will remain untreated in 2012. Treatment will resume in 2012 along the eastern portion of Arrowhead Marsh (17c), Fan Marsh Shore (17d.1), San Leandro Creek (17e), and Airport Channel (17k).

In 2012, about 53 – 62 clapper rails were detected in the San Leandro Bay region (**Table 5**). This represents a nearly -44% change from 2009. Much of this decline is driven by the trend at Arrowhead Marsh, a small but highly invaded site which supports a dense population of clapper rail. This site has had a phased *Spartina* treatment approach, where the western half of the site was fully treated from 2008 through 2010 while the eastern half was treated with a sub-lethal dose of herbicide in order to halt development of flowers but not kill the plants. As a result, hybrid *Spartina* is still the dominant vegetative cover for clapper rails at Arrowhead. Clapper rail populations at this site and in the region are likely to decline further when *Spartina* control work resumes again.

To support clapper rail populations in the region into the future, the ISP with its partners has begun the implementation of the restoration plan at several sites in San Leandro, including: Elsie Roemer, Damon Marsh, MLK New Marsh, and Arrowhead. Restoration partner Save-The-Bay (STB) implemented revegetation of upland transition zone habitat at a number of sites in the region. Additionally, ISP and STB planted *Grindelia stricta* and *Triglochin maritima* in the least infested portions of Arrowhead Marsh (**Figure 3**). Experimental plots of native *Spartina foliosa* were planted at Elsie Roemer by Whitney Thornton (San Francisco State University) in December 2011. Finally, USGS deployed 35 floating islands at Arrowhead Marsh in 2012: 25 smaller nesting islands and 10 larger refuge islands (which were initially deployed in 2011 and redeployed in 2012). The combination of restoration actions are intended to provide habitat for clapper rails as the remaining non-native *Spartina* is phased out of the region in the upcoming years.

Figure 3. *Grindelia stricta* plantings at Arrowhead Marsh adjacent to non-native *Spartina* infestation.

Table 5. Summary clapper rail and *Spartina* survey results from 2008-2011 in the San Leandro Bay Region.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	**2009**	**2010**	**2011**	**2012**	**Trend**	**2008**	**2009**	**2010**	**2011**	**Trend**
Elsie Roemer (17a)	1 - 2	1 - 2	0	0	↘	24.5%	13.3%	0.4%	0.3%	↘
Bay Farm Island (17b)	0	0	0	0	-	3.9%	1.1%	0.0%	0.0%	↘
Arrowhead Marsh (17c)	55ǂ	41 - 50	31 - 36	32 - 40	↘	42.4%	24.3%	26.1%	22.2%	↘
Airport Channel - Fan Shore (17d)	3 - 4	1 - 2	2	0	↘	21.6%	16.6%	6.0%	1.2%	↘
MLK Regional Shoreline (17d)	5 - 6	5 - 10	4	1 - 2	↘	7.3%	4.0%	4.0%	1.2%	↘
San Leandro Creek (17e)	2 - 4	3 - 4	1 - 2	0	↘	3.6%	2.0%	0.9%	0.4%	↘
Oakland Inner Harbor (17f)	0	0	0	0	-	1.4%	1.2%	0.8%	0.2%	↘
Coast Guard Is (17g)	0	0	0	0	-	11.1%	2.8%	0.1%	0.0%	↘
MLK New Marsh (17h)	15 - 18	14 - 18	13 - 14	18	↗	11.2%	11.2%	9.9%	12.8%	↗
Coliseum Channels (17i)	0	0	0	0	-	1.2%	0.3%	1.3%	0.1%	↘
Fan Marsh (17j)	10 - 14	12 - 14	8 - 10	2	↘	32.0%	21.4%	2.2%	0.9%	↘
Airport Channel (17k)	0	0	0	0	-	2.1%	1.7%	0.5%	0.1%	↘
Doolittle Pond (17l)	3 - 6	1 - 2	0	0	↘	9.4%	3.8%	1.2%	0.3%	↘
Alameda Island - East (17m)	1 - 2	1 - 2	0	0	↘	31.1%	13.5%	5.5%	1.4%	↘

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

ǂ 2009 data at Arrowhead Marsh collected by EBRPD during winter high-tide survey counts

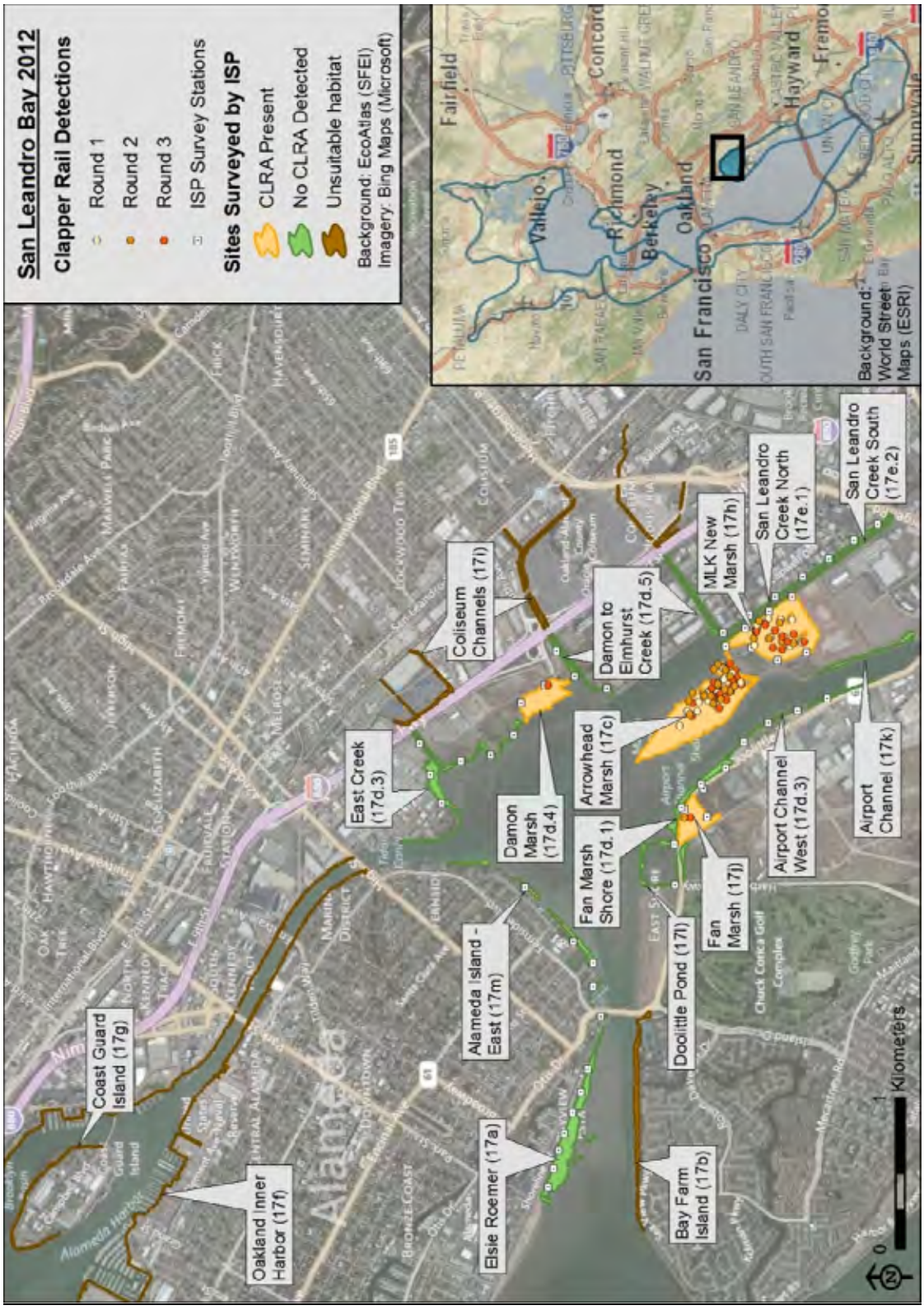

Figure 4. Map of clapper rail presence and absence in 2012 at ISP sites in the San Leandro Bay Region.

4.3 Hayward Region

Figure 5. View of the Hayward shoreline looking north from the San Mateo Bridge

The Hayward Region in Alameda County stretches from the Oakland Airport south to the San Mateo Bridge (**Figures 5 and 6**). Several large parcels of historic bayland have been restored to tidal flow in recent decades. These large marshes have simple vegetative composition, currently dominated by *Sarcocornia pacifica*, an early colonizer of tidal areas. Channels at these sites are also simple, lacking complex branching and sinuosity that develops over time. Predators were observed at over half the sites and are likely a big threat to clapper rails in the region.

Many of the younger restoration sites in the region have been heavily impacted by invasive *Spartina* and its subsequent removal. Most of the control work was accomplished in 2006 and 2007, with smaller yet continued reduction of *Spartina* cover from 2008 to 2010. However, in 2011 hybrid *Spartina* was left untreated at several sites in the region, including most of the Robert's Landing and Cogswell Complexes (20d, 20f, 20g, 20h, 20n, and 20o). In the single year of no treatment, non-native *Spartina* increased by 29% at the six sites which were not treated in 2011 and increased by about 9% over the entire region.

Interestingly, clapper rail numbers decreased at several of the sites where *Spartina* was left untreated, most notably Citation Marsh, which decreased from 20 rails detected in 2011 to 6 rails in 2012. Despite this decrease, we detected 55-70 clapper rails in total in the Hayward Region, indicating little change over the past four years (**Tables 3 and 6**).

In 2006, the ISP began revegetation in the region by planting *Grindelia stricta* seedlings in the marsh plain at Cogswell Marsh A and dispersing *G. stricta* seeds at the Oro Loma Complex. These efforts were greatly expanded upon in 2011 and 2012 by ISP's restoration program when several hundred *G. stricta* seedlings were planted at Cogswell and Oro Loma marshes. Next year, ISP plans to expand on the work that has been accomplished thus far and to planting at sites within the Robert's Landing complex.

In addition to the revegetation program, Coastal Conservancy funded a study by USGS to deploy 50 artificial floating islands between the Robert's Landing Complex and the Cogswell Marsh Complex. These small floating platforms are intended to provide temporary nesting habitat and refuge during high tides. Though still experimental in nature, similar structures have been successfully used in southern California to support light-footed clapper rail populations. Ideally, these islands will provide interim refuge for clapper rails as the remaining non-native *Spartina* is removed from the region.

Table 6. Clapper rail and *Spartina* survey results from 2008 – 2012 in the Hayward Region.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	2009	2010	2011	2012	Trend	2008	2009	2010	2011	Trend
Oro Loma - East (07a)	1 - 2	4 - 6	6	4	↗	4.0%	0.8%	0.1%	0.1%	↘
Oro Loma - West (07b)	1 - 2	0	0	1 - 2	→	6.2%	2.2%	0.4%	0.5%	↘
Oyster Bay Regional Shoreline (20a)	2 - 4	0	0	0	↘	15.9%	11.4%	3.0%	1.1%	↘
Oakland Golf Links (20b)	0	0	0	0	-	26.6%	29.2%	12.0%	1.5%	↘
Dog Bone Marsh (20c)	2	0	0	0	↘	6.6%	0.7%	0.4%	0.0%	↘
Citation Marsh (20d)	5 - 6	5 - 8	20-24	6 - 8	↗	1.6%	3.0%	0.4%	0.6%	↘
East Marsh (20e)	1 - 2	0	1 - 2	0	↘	0.0%	0.0%	0.0%	0.0%	-
North Marsh (20f)	6 - 10	12-16	14-20	8 - 10	↗	2.4%	6.0%	0.6%	0.4%	↘
Bunker Marsh (20g)	3 - 4	4 - 8	8 - 10	8	↗	2.1%	9.9%	1.0%	0.7%	↘
San Lorenzo Creek & Mouth (20h)	3 - 4	3 - 4	4 - 6	2 - 4	↘	2.7%	3.3%	1.4%	0.5%	↘
Bockman Channel (20i)	0	0	0	0	-	0.7%	0.2%	0.1%	0.1%	↘
Sulphur Creek (20j)	0	0	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Hayward Landing (20k)	0	0	1 - 2	0	-	1.5%	0.0%	0.0%	0.0%	↘
Johnson's Landing (20l)	0	0	0	0	-	1.4%	0.0%	0.0%	0.0%	↘
Cogswell - Sec A (20m)	3 - 4	6	3 - 4	0	↘	0.8%	4.1%	0.4%	0.8%	→
Cogswell - Sec B(20n)	23-33	20-28	9-12	17-20	↘	33.5%	7.8%	0.6%	1.6%	↘
Cogswell - Sec C (20o)	1 - 2	3 - 6	2 - 4	8 - 12	↗	3.8%	3.4%	0.5%	0.8%	↘
Hayward Shoreline Outliers (20p)	0	0	0	0	-	47.5%	0.2%	0.0%	0.0%	↘
San Leandro Shoreline Outliers (20q)	0	0	0	0	-	0.3%	0.2%	0.0%	0.0%	↘
Oakland Airport (20r)	no data	0	0	0	-	0.4%	0.5%	0.0%	0.2%	↘
HARD Marsh (20s)	1 - 2	0	0	1 - 2	→	0.0%	0.0%	0.0%	0.0%	-
San Leandro Marina (20t)	0	0	0	0	-	0.1%	0.1%	0.0%	0.0%	↘
Estudillo Creek Channel (20u)	0	0	0	0	-	0.6%	0.1%	1.0%	0.0%	↘
Hayward Landing Canal (20v)	0	0	0	0	-	0.4%	0.3%	0.1%	0.1%	↘
Triangle Marsh - Hayward (20w)	0	0	1 - 2	0	-	0.0%	0.0%	0.0%	0.0%	-

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

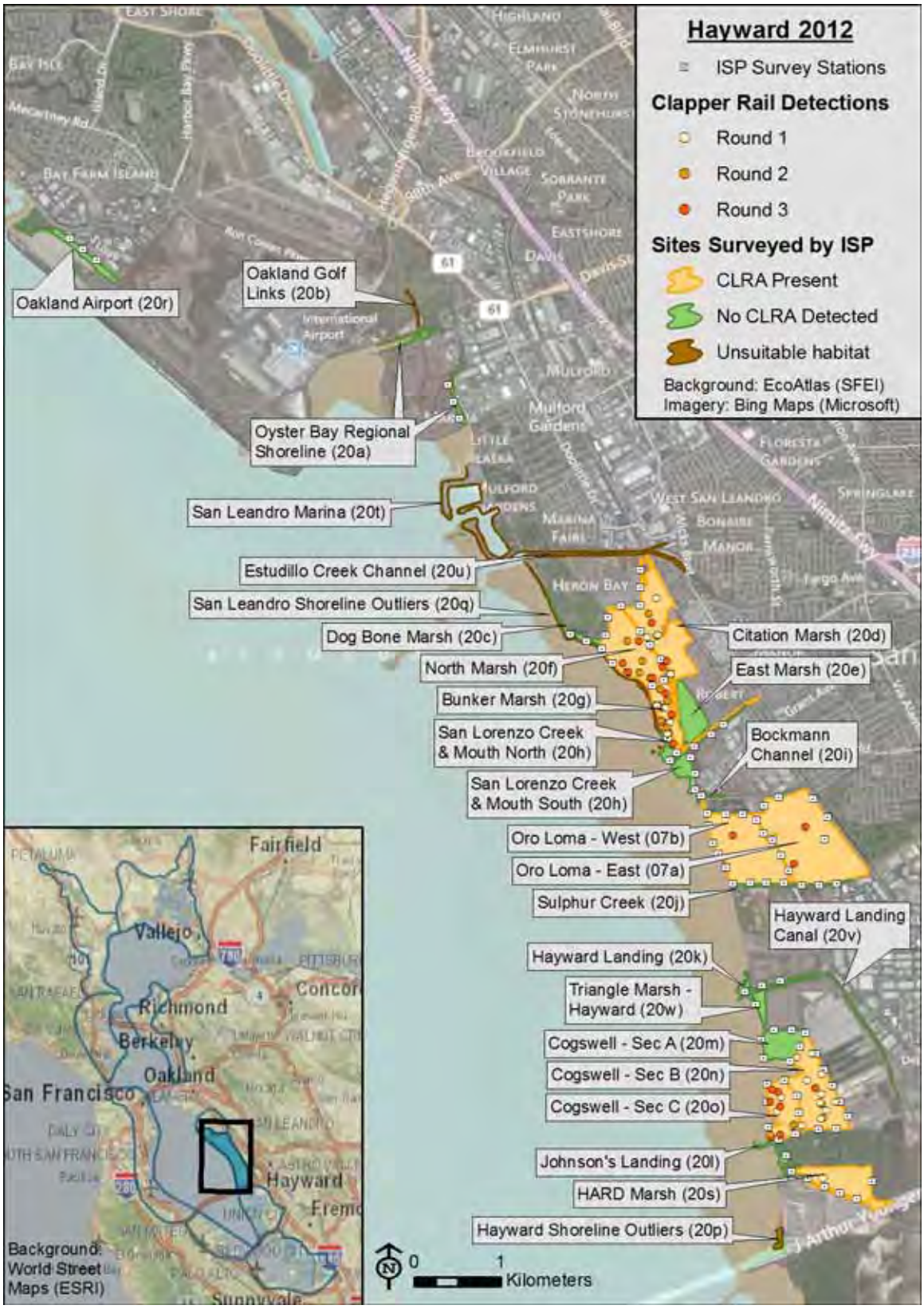

Figure 6. Map of clapper rail presence and absence in 2012 at sites surveyed by ISP in the Hayward Region.

4.4 Union City Region

The Union City Region in Alameda County stretches from the San Mateo Bridge to the Dumbarton Bridge (**Figure 8**). There are a variety of habitats in this region, including mature restoration marsh with a range of channel orders and morphologies, highly-channelized flood control conduits, young restoration sites with little vegetation or structure, and mudflats. As part of the South Bay Salt Pond Project, the Department of Fish and Game is in the process of restoring 2,500 hectares of former salt ponds to tidal wetlands in the Eden Landing Complex (**Figure 7**).

The region includes 20 ISP clapper rail sites, eleven of which were surveyed by the ISP in 2012. The remaining nine sites were surveyed by staff at Don Edwards National Wildlife Refuge. ISP detected 11-12 clapper rail in the region in 2012 (**Table 7**) and staff at FWS detected an additional 29 clapper rails within the region.

The Union City Region was the epicenter of the *Spartina* invasion and site of initial introduction of *Spartina alterniflora* to the Estuary. Accordingly, hybrid *Spartina* has had a large impact on the marshes and channels of the region, wiping out nearly all native *Spartina foliosa*. During peak infestation from 2004 to 2005, nearly one third of the available marsh habitat in the region was hybrid *Spartina*. Successful *Spartina* control since 2006 has greatly reduced the invasion to its current level of less than a tenth of a percent of available habitat. Clapper rail numbers declined in the region from 2006 to 2009, following the changes in habitat as invasive *Spartina* was removed. Since 2009, however, clapper rail numbers in the region have stabilized (at sites surveyed by ISP) or increased (at sites surveyed by FWS). This positive trajectory is expected to continue as the former salt ponds within the region mature into diverse tidal marshes.

ISP and its partners have contributed to the restoration in the region with plantings of native *Spartina foliosa* and *Grindelia stricta* at several sites within the Eden Landing complex (and the AFCC complex. Additionally, the Coastal Conservancy funded the installation of 25 floating islands at Whale's Tail North as part of an experimental study by USGS to support breeding clapper rails.

Figure 7. An aerial view of the Eden Landing complex showing the combination of young restoration sites, former salt ponds, and mature marshes in the region.

Table 7. Clapper Rail and *Spartina* survey results from 2008 – 2011 in the Union City Region.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	**2009**	**2010**	**2011**	**2012**	**Trend**	**2008**	**2009**	**2010**	**2011**	**Trend**
AFCC - Strip Marsh (01e)	0	no data	0	0	-	0.7%	0.1%	0.0%	0.0%	↘
OAC - North Bank (13a)	2	no data	0	0	↘	2.7%	0.3%	0.0%	0.0%	↘
OAC - Island (13b)	8 - 9	no data	2 - 4	3 - 4	↘	2.7%	0.2%	0.0%	0.0%	↘
OAC - South Bank (13c)	0	no data	0	0	-	3.8%	0.0%	0.1%	0.0%	↘
Whale's Tail - North (13d)	2	no data	8-12	8	↗	0.2%	0.1%	0.0%	0.0%	↘
OAC - Upstream 20 Tide Gates (13g)	no data	no data	0	0	-	0.4%	0.0%	0.0%	0.0%	↘
Eden Landing - North Creek (13h)	0	0	0	0	-	0.3%	0.1%	0.1%	0.0%	↘
Eden Landing - Pond 10 (13i)	0	0	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Eden Landing - Mt Eden Creek (13j)	0	2 - 4	2	0	-	0.0%	0.1%	0.0%	0.0%	-
Eden Landing Reserve - South (13k)	0	0	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Eden Landing Reserve - North (13l)	no data	no data	0	0	-	0.0%	0.0%	0.0%	0.0%	-

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

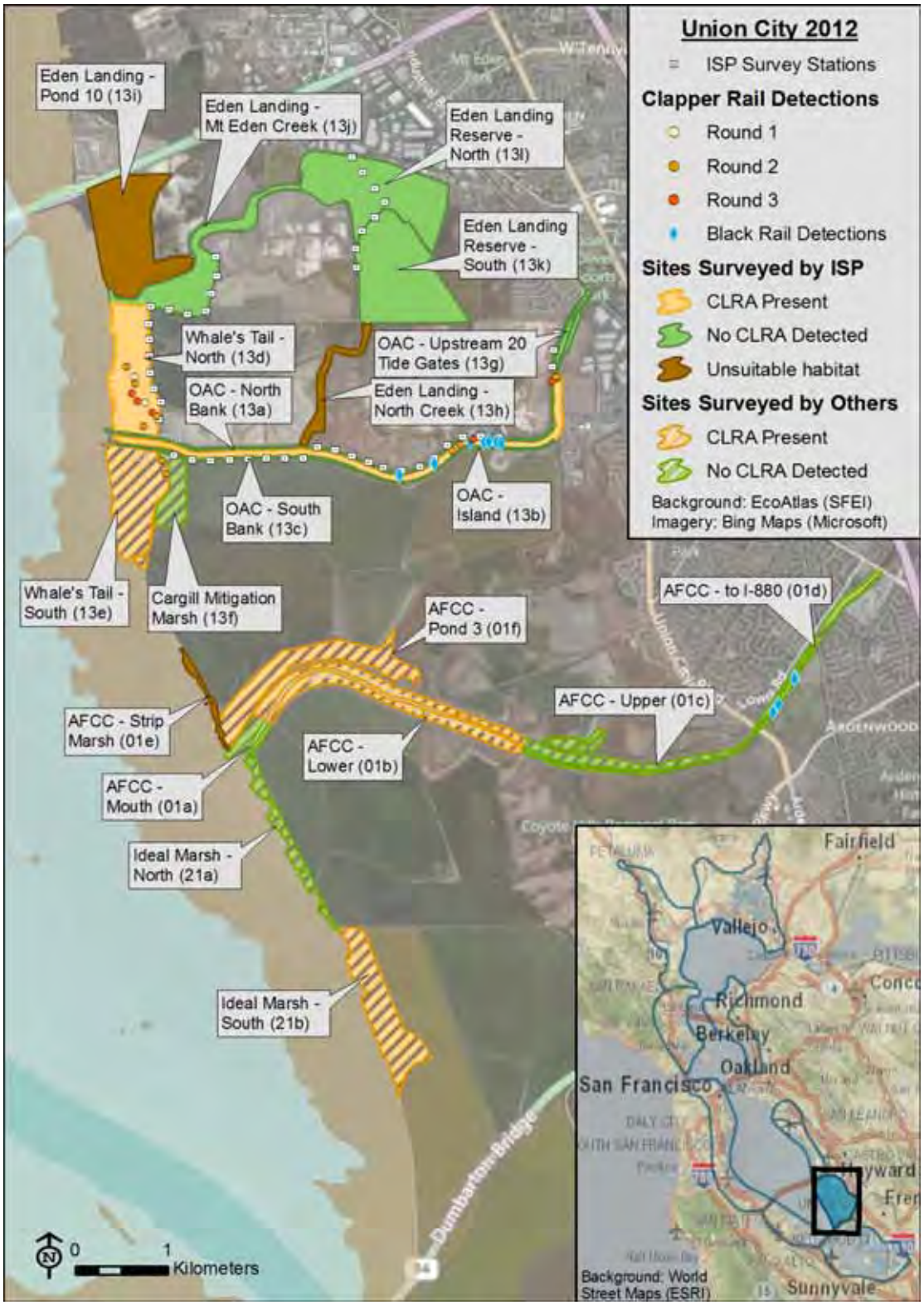

Figure 8. Map of clapper rail presence and absence in the Union City region in 2012. Sites not surveyed by the ISP were surveyed by biologists at the Don Edwards National Wildlife Refuge (DENWR). Detections shown at Whales Tail South were ISP detections from adjacent site; detections from biologists at DENWR are not shown on this map.

4.5 Dumbarton South – Newark, Alviso, & Mountain View Regions

Dumbarton South is a combination of the three regions south of the Dumbarton Bridge: Newark Region, Alviso Region, and Mountain View Region (**Figure 10**). Sites in these three regions are generally large parcels of mature marshes on managed and protected lands. They include a variety of habitat types, including freshwater creeks, restored salt ponds, tidal and brackish sloughs, creek deltas, fringing tidal marsh benches, and historic tidal marsh plains. The complex vegetative structure and channel networks of the sites in these regions provide excellent habitat for clapper rails. Accordingly, the region supports large numbers of clapper rails and some of the most densely occupied sites.

In the past, the region was not well surveyed for clapper rails because of the large size of sites and the relatively small infestation of *Spartina*. In 2012, we increased our survey effort in the area and conducted clapper rail surveys at 14 of the 30 ISP clapper rail sites (**Table 8**), including Calaveras Marsh. Biologists at PRBO and DENWR also conducted surveys in the region at several of the more densely populated sites, including LaRiviere Marsh, Palo Alto Baylands, and Faber and Laumeister Marshes. Because survey effort has been inconsistent in this region, it is difficult to get an accurate sense of the clapper rail trend. However, there was a noticeable increase in the number of clapper rails detected at Dumbarton Marsh in 2012 over 2011 and at Mowry Marsh in 2012 over 2009. Though we do not have previous data to compare, the number of clapper rails detected at Calaveras Marsh indicates that it is one of the most densely populated sites in the South Bay, and certainly within the Dumbarton South Region (**Figure 9**).

Hybrid *Spartina* at Cooley Landing, Alviso Slough, and Calaveras Marsh was not treated in 2011 due to concerns about clapper rail populations, however ISP will resume treatment at these sites in 2012 provided that the habitat at these sites is enhanced for clapper rails. Plans to enhance the clapper rail habitat in the region include the installation of six floating islands at the following four sites during the winter of 2012-13: Calaveras Marsh (05a.2), Alviso Slough (15a.4), Cooley Landing (16), and Palo Alto Baylands (08). Additionally, one earthen island will be installed at Cooley Landing (16) this winter as part of a pilot project to determine the best method for creating permanent high tide refugia for clapper rails. Five more earthen islands will be installed at the remaining three sites mentioned above during the following winter.

Figure 9. Image of Calaveras Marsh from above, showing large continuous marsh with complex channelization.

Table 8. Clapper rail and *Spartina* survey results from 2008 – 2012 at ISP sites within the three regions south of the Dumbarton Bridge.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	**2009**	**2010**	**2011**	**2012**	**Trend**	**2008**	**2009**	**2010**	**2011**	**Trend**
Cooley Landing (16)	4 - 6	3 - 4	2 - 4	1 - 2	↘	6.7%	4.9%	1.7%	1.0%	↘
Ravenswood Open Space Preserve (02j)	0	0	0	0	-	0.3%	0.5%	0.8%	0.1%	↘
Mowry Marsh North (05a)	6 - 8	no data	no data	16-24	↗	0.3%	0.1%	0.0%	0.0%	↘
Calaveras Point (05a)	no data	no data	no data	37-46	-	1.0%	0.4%	0.8%	0.1%	↘
Dumbarton/Audubon (05b)	11-16	13-18	13-18	34-46	↗	0.8%	0.3%	0.2%	0.1%	↘
Newark Slough (05c)	3 - 6	5 - 8	5 - 8	8	↗	0.6%	0.4%	0.1%	0.2%	↘
Plummer Creek Mitigation (05h)	no data	no data	no data	0	-	0.0%	0.0%	0.1%	0.2%	↗
Mountain View Slough (15a)	1 - 2	2 - 4	no data	3 - 6	↗	0.3%	0.1%	0.1%	0.0%	↘
Charleston Slough Mouth (15a)	1 - 2	2	1	5 - 8	↗	0.6%	0.1%	0.1%	0.0%	↘
Guadalupe Slough (15a)	no data	no data	no data	1 - 2	-	0.1%	0.0%	0.0%	0.0%	↘
Stevens Creek to Long Point (15a)	0	0	0	0	-	1.8%	0.1%	0.2%	0.0%	↘
Alviso Slough (15a)	no data	9 - 10	4 - 6	1 - 2	↘	0.2%	0.2%	0.2%	0.1%	↘
Coyote Creek South East (15a)	no data	no data	9 - 10	6 - 10	↘	0.0%	0.0%	0.0%	0.0%	-
Stevens Creek (15c)	no data	0	0	0	-	0.6%	0.7%	2.0%	0.2%	↘

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

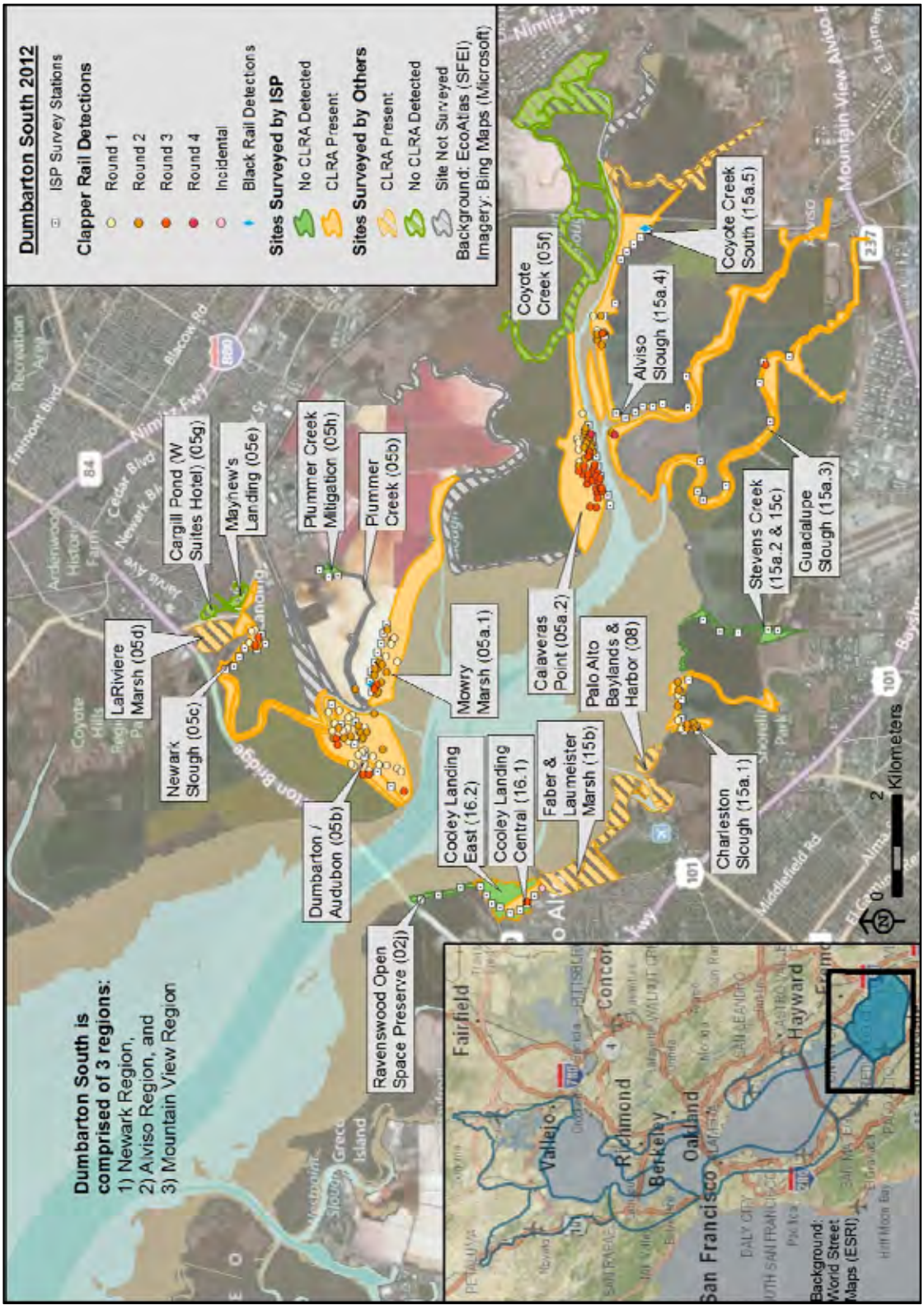

Figure 10. Map of clapper rail presence and absence in 2012 at ISP sites south of the Dumbarton Bridge. Though no clapper rails were detected in Cooley Landing East (16.2) during regular surveys by ISP, PRBO detected a single rail within the subsite during surveys at neighboring Laumeister Marsh.

4.6 San Mateo Region

The San Mateo clapper rail region stretches from the San Mateo Bridge to the Dumbarton Bridge on the west side of the Bay (**Figure 11**). This region contains a variety of wetland habitats, including marsh islands, active and inactive commercial salt ponds, large tidal channels, and bayfront strip marshes. Channel mouths and younger restoration sites have been heavily invaded by hybrid *Spartina*, sometimes coalescing into large meadows. These sites were treated by helicopter in the past and vegetation is patchy. The older marsh parcels and the upper reaches of tidal channels are generally more resistant to invasion by *Spartina* and show less impact by subsequent control efforts. Predators, particularly raptors, are abundant at sites in this region; this is possibly due to the prevalence of prominent perches (e.g., power towers).

The region includes 18 ISP clapper rail sites, sixteen of which were surveyed by the ISP in 2012. B2 North Quadrant was surveyed by PRBO Conservation Science and Redwood Creek was not surveyed in 2012. ISP detected 93-120 clapper rails in the San Mateo Region in 2012, which is a continuation of the positive trend over the past four years (**Table 9**).

Because many of the sites in the complex are large and difficult to access, *Spartina* control work in the region has been challenging. At several sites in particular, delays in treatment have resulted in slightly rebounded *Spartina* cover since 2008. Additionally, several sites in the San Mateo Region were not treated in 2011 due to concerns about clapper rails still reliant on invasive *Spartina* for habitat. Portions of Belmont Slough (02a), Redwood Shores (02a), B2 North Quadrant (02c), and B2 South Quadrant (02d) were not treated, as well as all of West Point Slough NW (02e) and Ravenswood Slough (02i). ISP will resume treatment at these sites in 2012 provided that the habitat at these sites is enhanced for clapper rails.

Last winter, ISP planted *Grindelia stricta* at B2 North Island (02c.1) and Greco Island North (02f). Next year, ISP plans to expand upon those plantings and initiate plating at several other sites including Belmont Slough (02a.1), Bird Island (02a.3), and B2 South (02d). In addition to revegetation efforts, USGS deployed 25 floating islands at Greco to support breeding rail during the spring and summer of 2012. USGS monitored these islands for signs of use by clapper rail, but did not detect any nesting. Based upon what was learned from the USGS study, this winter a total of eight additional floating islands will be deployed using an improved design. Finally, three earthen high-tide refuge islands are being planned for installation this winter at Belmont Slough, Bird Island, and B2 North as part of a pilot project.

Table 9. Clapper rail and *Spartina* survey results at sites in the San Mateo Region from 2008 – 2012.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	**2009**	**2010**	**2011**	**2012**	**Trend**	**2008**	**2009**	**2010**	**2011**	**Trend**
Redwood Shores (02a)	1 - 2	2	2 - 4	6 - 10	↗	1.1%	0.1%	0.1%	0.2%	↘
Belmont Slough (02a)	7 - 10	3 - 4	4 - 6	3 - 4	↘	1.9%	2.5%	1.1%	1.0%	↘
Steinberger Slough (02b)	0	0	0	0	-	2.4%	1.9%	1.3%	0.3%	↘
Corkscrew Slough (02b)	6	22-26	12-20	17-20	↗	0.1%	0.3%	0.1%	0.4%	↗
B2 South Quadrant (02d)	7 - 12	7 - 8	6	4 - 6	↘	0.5%	1.7%	1.0%	0.9%	↗
West Point Slough - NW (02e)	0	1 - 2	2	0	-	1.8%	2.4%	4.4%	3.9%	↗
Greco Island - North (02f)	7 - 10	11-14	7 - 12	18-20	↗	2.0%	0.8%	0.4%	0.4%	↘
West Point Slough - SW / E (02g)	0	1 - 2	0	1 - 2	↗	5.5%	7.5%	0.8%	0.1%	↘
Greco Island - South (02h)	8 - 14	24-26	22-30	22-30	↗	2.2%	2.1%	0.6%	0.7%	↘
Ravenswood Slough/Mouth (02i)	3 - 7	3 - 6	9 - 12	1 - 2	↘	2.8%	1.5%	0.6%	0.2%	↘
Middle Bair SE (02k)	no data	8	9	2 - 4	↘	0.1%	0.3%	0.1%	0.1%	→
Middle Bair N (02k)	10-11	10-12	14-28	19-20	↗	0.3%	1.0%	0.3%	0.9%	↗
Inner Bair Island Restoration (02l)	no data	0	0	0	-	0.3%	0.1%	0.5%	0.0%	↘
Pond B3 Bair Island Restoration (02m)	no data	no data	no data	0	-	0.0%	0.0%	0.0%	0.0%	-
Foster City (19q)	0	0	0	0	-	3.2%	0.5%	0.0%	0.0%	↘
Maple Street Channel (19s)	no data	no data	no data	0	-	0.0%	0.0%	0.6%	0.5%	↗

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

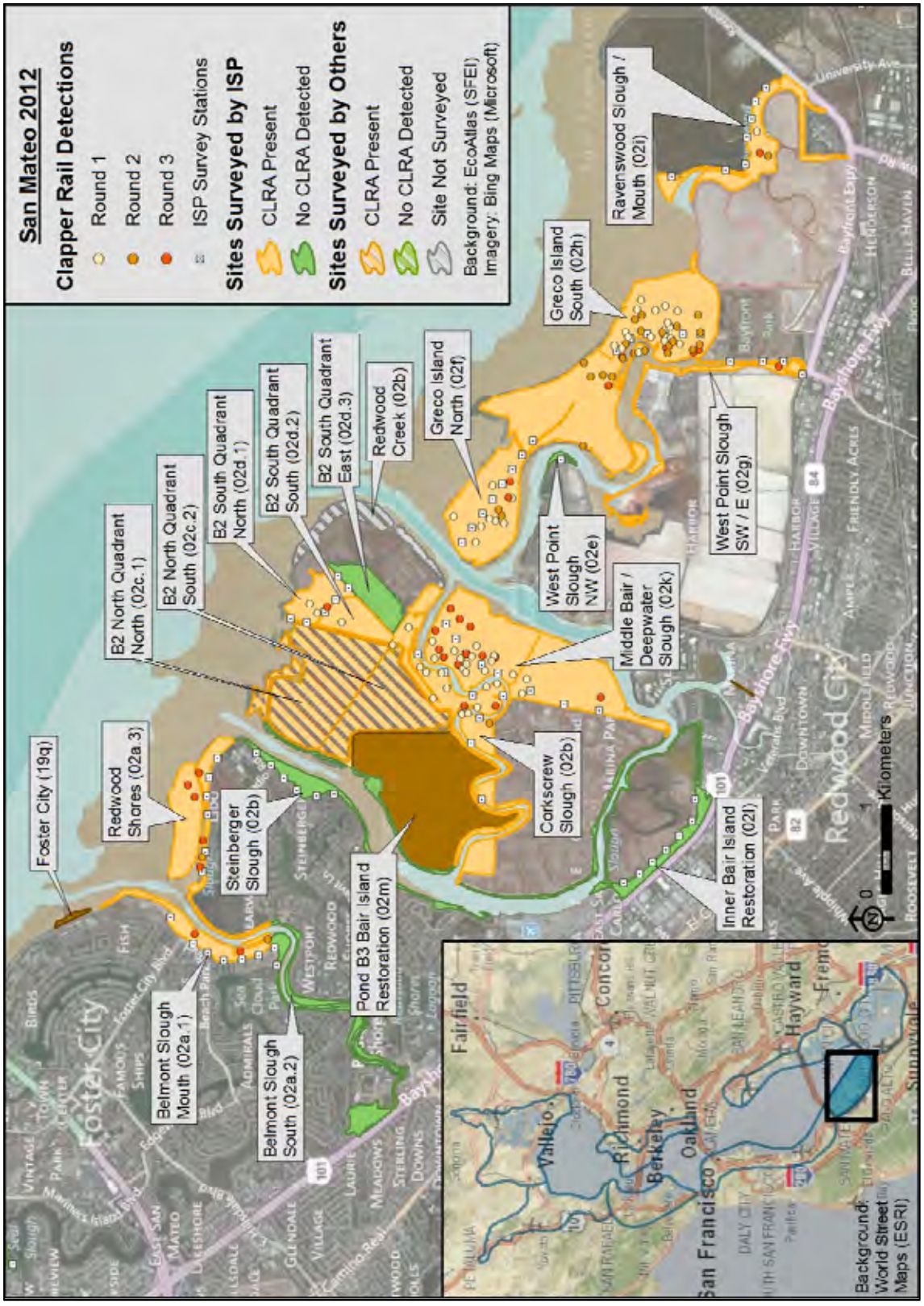

Figure 11. Map of clapper rail presence and absence in 2012 in the San Mateo Region. Sites not surveyed by the ISP were surveyed by biologists at PRBO Conservation Science.

4.7 San Francisco Peninsula Region

The San Francisco Peninsula Region stretches from the Golden Gate Bridge to the San Mateo Bridge (**Figure 13**). This urban region is highly developed and includes several marinas, tidal lagoons, flood control channels, small fragmented patches of remnant marsh, invaded mudflats, and the mouths of several creeks and sloughs. A wide range of land uses can be found here, from SFO Airport and shipyards, to light and heavy industry, to commercial and residential development. It includes the cluster of marshes within the Colma Creek complex, as well as the scattered sites along the length of the Peninsula.

The *Spartina* invasion had significant impacts within San Francisco Peninsula, creating marsh where there was none before by converting mudflats into *Spartina* meadows. Several of these newly created marshes were occupied by clapper rails, whose populations expanded and thrived in the *Spartina* monoculture. At peak infestation nearly two thirds of the available habitat was non-native *Spartina*. Effective control since 2007 had greatly reduced the *Spartina* infestation and significantly altered the habitat (**Figure 12**). By 2009, clapper rail numbers had already declined substantially. Survey results from the past three years seem stable, though at levels much lower than during the peak *Spartina* infestation (**Table 10**).

Figure 12. Photo series documenting change in habitat over time. Photos were taken from the same location along Colma Creek (18a) in 2006, 2008, 2010, and 2012. In 2006, the creek banks were wide meadows of hybrid *Spartina*. By 2010, the creek was lined with native vegetation such as *Grindelia stricta* and *Sarcocornia pacifica*.

Due to concerns over clapper rail declines in the region, Seal Slough, SFO, and Confluence Marsh were not treated in 2011. These sites will be treated in 2012 with the concurrent enhancement of habitat for clapper rails at the limited number of sites where appropriate. This winter, we plan to install and plant a high-tide refuge at Seal Slough as part of an experimental pilot project. Additionally, portions of the Colma Creek complex were experimentally planted with native *Spartina foliosa*. There are very few other opportunities for habitat enhancement along this urban shoreline.

Table 10. Clapper rail and *Spartina* survey results at the San Francisco Peninsula Region from 2008 – 2012.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	2009	2010	2011	2012	Trend	2008	2009	2010	2011	Trend
Pier 94 (12a)	0	no data	0	0	-	0.2%	0.1%	0.1%	0.2%	→
Pier 98/Heron's Head (12b)	0	1	1 - 2	1 - 2	↗	0.4%	0.1%	0.0%	0.1%	↘
India Basin (12c)	0	0	0	0	-	0.5%	1.9%	0.0%	0.0%	↘
Hunters Point Naval Reserve (12d)	0	0	0	0	-	35.4%	17.7%	0.9%	0.0%	↘
Yosemite Channel (12e)	0	0	0	0	-	0.2%	2.8%	0.6%	0.1%	↘
Candlestick Cove (12f)	0	0	1 - 2	0	-	25.9%	6.4%	0.8%	0.0%	↘
Crissy Field (12g)	0	no data	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Yerba Buena Island (12h)	no data	no data	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Mission Creek (12i)	0	no data	0	0	-	0.1%	0.1%	0.0%	0.0%	↘
Colma Creek (18a)	0	0	0	0	-	10.6%	6.5%	0.1%	0.1%	↘
Navigable Slough (18b)	0	0	1	0	-	11.8%	1.3%	0.0%	0.1%	↘
Old Marina (18c)	0	0	0	0	-	25.4%	22.1%	0.1%	0.4%	↘
Inner Harbor (18d)	0	0	0	0	-	32.4%	6.4%	0.5%	0.1%	↘
Sam Trans Peninsula (18e)	2	1 - 2	0	0	↘	44.8%	15.3%	5.0%	0.1%	↘
Confluence Marsh (18f)	4	1 - 2	2	0	↘	21.0%	13.8%	1.0%	0.4%	↘
San Bruno Marsh (18g)	9 - 12	0	0	0	↘	48.5%	11.8%	2.3%	0.5%	↘
San Bruno Creek (18h)	0	0	0	0	-	0.8%	1.0%	0.2%	0.0%	↘
Brisbane Lagoon (19a)	0	0	0	0	-	4.8%	5.7%	0.9%	0.1%	↘
Sierra Point (19b)	2	0	0	0	↘	2.5%	17.8%	0.7%	0.8%	↘
Oyster Cove (19c)	0	0	0	0	-	8.6%	1.8%	0.0%	0.1%	↘
Oyster Point Marina (19d)	0	0	0	0	-	3.4%	3.0%	0.1%	0.0%	↘
Oyster Point Park (19e)	0	0	0	0	-	12.4%	3.7%	0.0%	0.5%	↘
Point San Bruno (19f)	0	2	0	0	-	15.3%	1.7%	6.5%	0.2%	↘
Seaplane Harbor (19g)	1 - 2	0	0	0	↘	7.9%	10.4%	0.2%	0.0%	↘
SFO (19h)	2 - 4	1 - 2	2 - 4	3 - 4	→	3.2%	3.4%	0.6%	0.3%	↘
Mills Creek Mouth (19i)	0	0	0	0	-	3.7%	8.2%	8.9%	0.3%	↘
Easton Creek Mouth (19j)	0	0	0	0	-	5.9%	21.6%	0.8%	0.3%	↘
Sanchez Marsh (19k)	0	0	0	0	-	0.9%	1.9%	1.6%	0.6%	↘
Burlingame Lagoon (19l)	0	0	0	0	-	5.3%	7.4%	1.1%	0.1%	↘
Fisherman's Park (19m)	0	0	0	0	-	0.1%	0.2%	0.0%	0.0%	↘
Coyote Point Marina (19n)	0	0	0	0	-	1.7%	2.7%	1.0%	0.0%	↘
San Mateo Creek (19o)	0	0	0	0	-	1.0%	1.4%	0.2%	0.1%	↘
Seal Slough Mouth (19p)	7 - 10	1 - 2	3 - 4	0 ¥	↘	13.5%	3.9%	3.5%	2.2%	↘
Anza Lagoon (19r)	0	0	0	0	-	0.1%	0.1%	0.0%	0.1%	→

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

¥ Though no rails were detected during standard protocol surveys in 2012, 3-4 clapper rails were detected during the national protocol surveys for the pilot study.

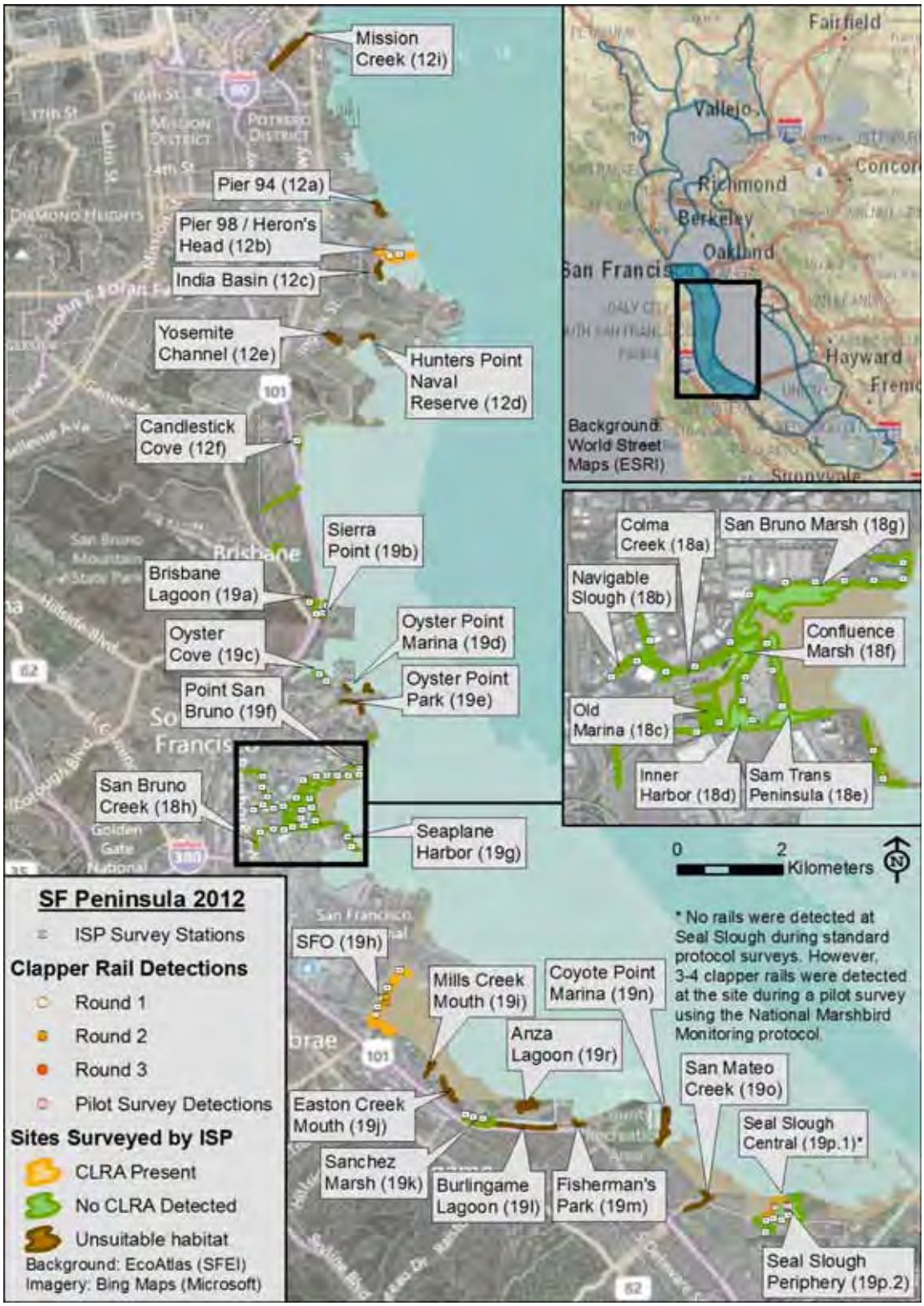

Figure 13. Map of clapper rail presence and absence in 2012 at ISP sites in the San Francisco Peninsula Region. Note Crissy Field (site 12g) is located in northern San Francisco and is not displayed on this map. No rails were detected at Seal Slough during standard protocol surveys, however 3-4 clapper rails were detected during national protocol surveys for the pilot study.

4.8 Marin Region

The Marin Clapper Rail Region stretches from the Golden Gate Bridge to the Richmond Bridge and contains small, disconnected sites scattered throughout the shoreline and marshes of Marin County (**Figure 14**). The shoreline is fairly developed, with a variety of wetland habitat types, including several marinas, tidal lagoons, flood control channels, small fragmented marshes, large restored marshes, invaded mudflats, and several creeks and sloughs.

The region includes thirty ISP clapper rail sites, twenty-two of which were surveyed by the ISP in 2012 (**Table 4**). PRBO surveyed the eight other more densely occupied tidal marshes in this region, including the Corte Madera Ecological Reserve, Muzzi and Martes Marshes. In general, sites surveyed by ISP have shown a little change in clapper rail detections over the past four years (**Table 11**). As an exception, Pickleweed Park (aka Tiscornia Park) has shown a noticeable decline in rail detections since 2011; presumably unrelated to *Spartina* control, which has been minimal at the site.

The ISP Control Program has battled several species of non-native *Spartina* in the Marin Region, which has been the epicenter of the *S. densiflora* invasion in the Estuary. The extent of *S. densiflora* has been greatly reduced in the watershed due to successful control. However, both hybrid *Spartina* and *S. densiflora* were left untreated at CMC Mouth (04j) in 2011, allowing for seed set and re-expansion of the invasion. Treatment of this site will resume in 2012 with concurrent enhancement of habitat for clapper rails. ISP plans to install two floating islands at CMC Mouth. Additionally, Friends of Corte Madera Creek Watershed have begun restoration work at Creekside Park to enhance habitat for resident rails.

Table 11. Clapper rail and *Spartina* survey results at the Marin Region from 2008 – 2012.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	**2009**	**2010**	**2011**	**2012**	**Trend**	**2008**	**2009**	**2010**	**2011**	**Trend**
Pickleweed Park (09)	4 - 8	10	8	1 - 2	↘	0.0%	0.1%	0.3%	0.0%	-
Blackie's Creek (03a)	0	0	0	0	-	2.1%	6.5%	0.9%	0.4%	↘
Blackie's Creek Mouth (03b)	0	0	0	0	-	4.8%	7.2%	1.5%	0.5%	↘
College of Marin (04b)	0	0	0	0	-	0.3%	0.1%	0.1%	0.0%	↘
Larkspur Ferry Landing (04e)	0	0	0	0	-	0.1%	0.7%	0.1%	0.4%	↗
Riviera Circle (04f)	0	0	0	0	-	2.3%	3.2%	1.0%	0.2%	↘
Creekside Park (04g)	11-22	8-9	9-12	12-14	→	4.7%	4.5%	1.0%	0.2%	↘
CMC - Upper (04h)	3	4 - 6	8	3 - 4	→	0.1%	0.2%	0.2%	0.2%	↗
CMC - Lower (04i)	2	0	0	0	↘	1.1%	0.8%	0.2%	0.3%	↘
CMC - Mouth (04j)	3 - 4	7 - 8	5 - 6	2 - 4	→	0.9%	2.7%	2.2%	0.3%	↘
Murphy Creek (04l)	0	0	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Brickyard Cove (23a)	0	0	0	0	-	0.1%	0.0%	0.0%	0.0%	↘
Beach Drive (23b)	0	0	0	0	-	1.4%	2.6%	2.1%	0.3%	↘
Loch Lomond Marina (23c)	0	0	0	0	-	0.0%	0.1%	0.1%	0.1%	↗
San Rafael Canal Mouth (23d)	2	2	2	2	→	0.1%	0.9%	0.5%	0.2%	↗
Paradise Cay (23f)	0	0	0	0	-	0.1%	0.1%	0.0%	0.0%	↘
Greenwood Beach (23g)	0	0	0	0	-	0.7%	0.4%	0.0%	0.0%	↘
Strawberry Point (23h)	0	0	0	0	-	0.0%	0.1%	0.0%	0.0%	-
Strawberry Cove (23i)	0	0	0	0	-	0.1%	0.3%	0.1%	0.1%	→
Sausalito (23k)	0	0	0	0	-	0.0%	0.0%	0.0%	0.0%	-
Starkweather Park (23l)	0	0	0	0	-	0.0%	0.1%	0.0%	0.0%	-
Triangle Marsh - Marin (23n)	0	0	0	0	-	0.0%	0.1%	0.1%	0.0%	-

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

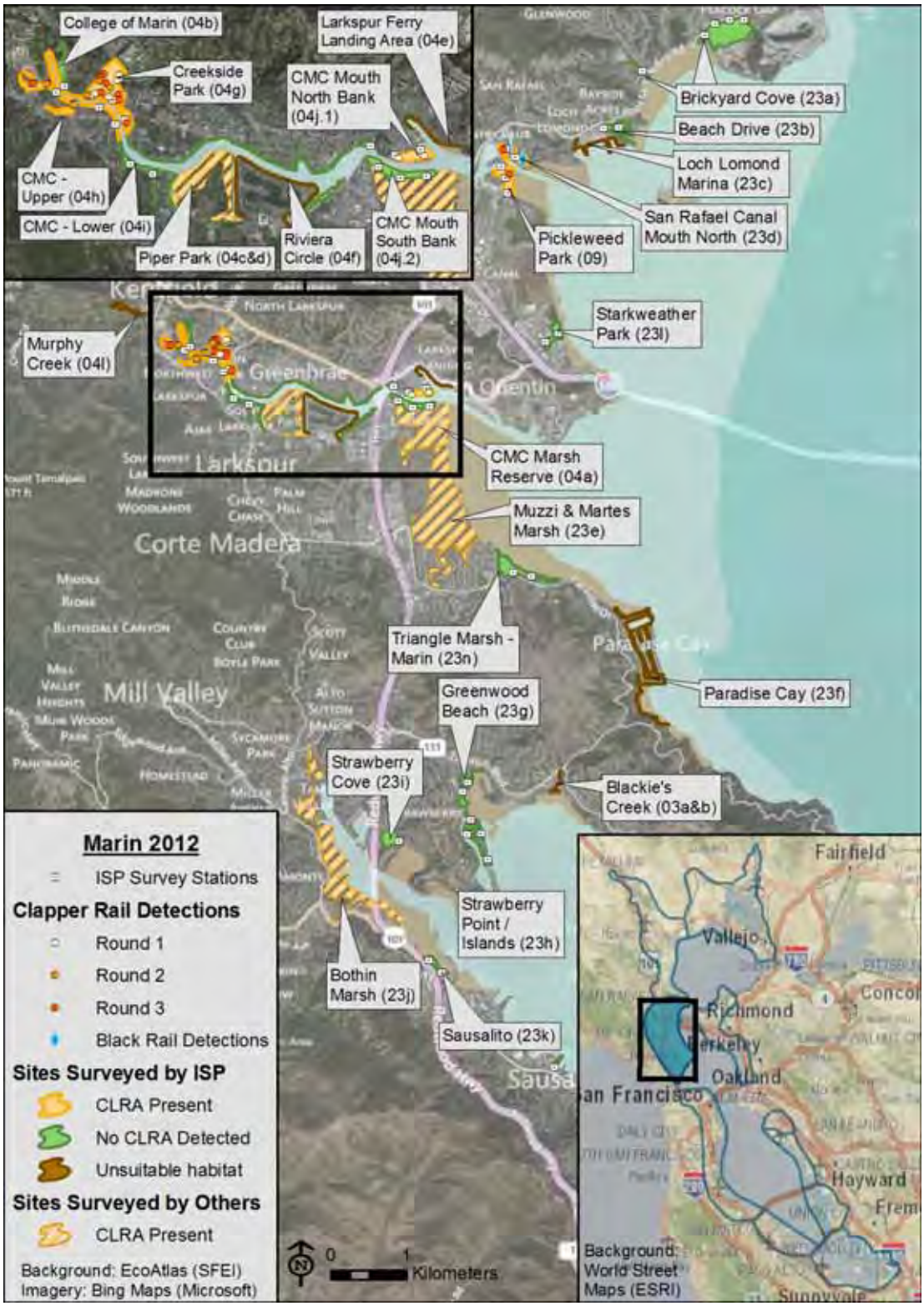

Figure 14. Map of clapper rail presence and absence in 2012 at ISP sites within the Marin Region. Sites not surveyed by the ISP were surveyed by biologists at PRBO Conservation Science (PRBO detections are not shown on this map).

4.9 San Pablo Bay – Vallejo and Petaluma Regions

San Pablo Bay includes both the Vallejo and Petaluma clapper rail regions (**Figure 16**). The Petaluma Region includes some of the largest and most densely occupied marshes in the North Bay, including McInnis Marsh, Gallinas Creek, and the marshes along the Petaluma River. Most sites within this region are surveyed by PRBO. However, there is a small portion of Upper Petaluma River (24a) with a focused hybrid invasion which was surveyed by ISP in 2012.

The bulk of wetlands in the Vallejo region were created by diking the mouth of the Napa River to create agricultural lands and salt production ponds. Restoration of over 10,000 ha of wetlands is either planned or underway in the region, the bulk of which is comprised of these leveed ponds. The high freshwater influence and the very "young" status of many of these sites means there are few clapper rails in the region, though these sites have considerable future potential for rail habitat, especially in light of predicted sea level rise.

The *Spartina* invasion in both regions has been insignificant (**Table 12**). Isolated clones of hybrid *Spartina* and small patches of *S. densiflora* were detected early and treated promptly.

No clapper rails were detected at San Pablo Bay NWR Shoreline at Mare Island, though only a very small portion of the site was surveyed. A single clapper rail was detected at Upper Petaluma River, as well as several Virginia Rails.

Figure 15. Photo overlooking the large shoreline of Mare Island's San Pablo Bay NWR (26b)

Table 12. Clapper rail and *Spartina* survey results at the two sites in San Pablo Bay surveyed by the ISP.

	Clapper Rail Detections					Percent Cover Non-native *Spartina**				
Site Name and ID	2009	2010	2011	2012	Trend	2008	2009	2010	2011	Trend
Petaluma River - Upper (24a)	no data	3 - 6	no data	1 - 2	-	0.0%	0.0%	0.0%	0.0%	-
San Pablo Bay NWR Shoreline (26b)	0	0	0	0	-	0.0%	0.0%	0.0%	0.0%	-

* Net cover of non-native Spartina within site boundaries, estimated to nearest tenth of a percentage.

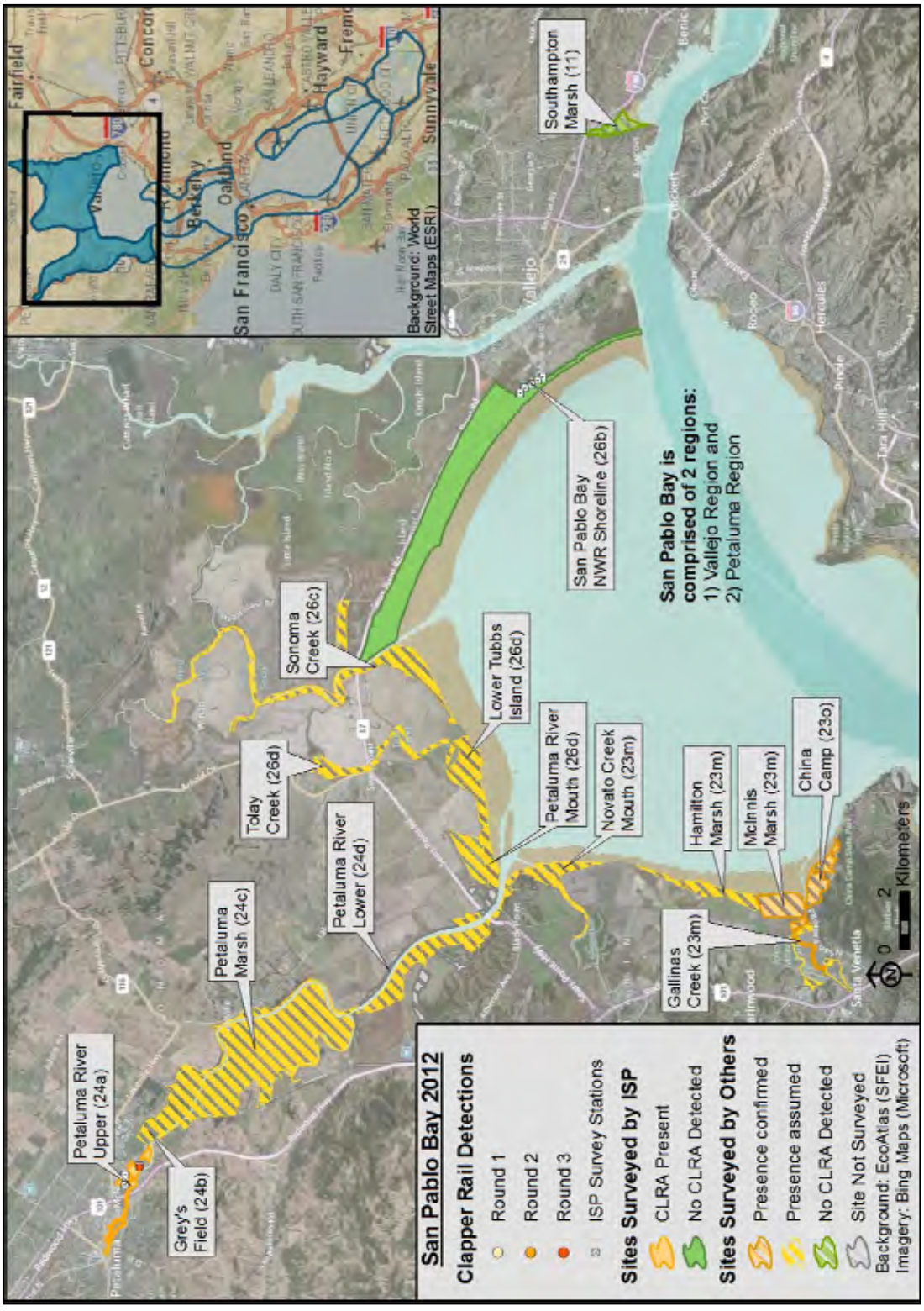

Figure 16. Map showing clapper rail presence and absence in 2012 at ISP sites within the Vallejo and Petaluma Regions. Note that only two sites within this large area were surveyed by ISP. The remaining sites were surveyed by PRBO Conservation Science.

4.10 Pilot Study on National Marsh Bird Monitoring Protocol

Staff at ISP also participated in a pilot study to evaluate the effects of broadcasting calls of conspecifics (as recommended by the national marsh bird monitoring protocol) on the detection probability of tidal marsh rails. Twelve ISP sites were surveyed using both the survey standard protocol and the national monitoring protocol: Emeryville Crescent West (06b), Rheem Creek Area (22c), MLK New Marsh (17h), Citation Marsh (20d), Cogswell Section B (20n), Old Alameda Creek (13b), Dumbarton/Audubon (05b), Newark Slough (05c), Alviso Slough (15a.4), Belmont Slough Mouth (02a.1), Greco Island South (02h), Ravenswood Slough (02i), and Seal Slough Mouth (19p).

A cursory comparison of data collected by ISP using the two different survey methods indicates a higher detection frequency using the national survey protocol. Clapper rails were detected during 39% of the station visits when using the national protocol compared to 27% of the visits to stations using the standard survey protocol. The national protocol yielded a greater detection frequency at all sites but one (**Figure 17**). Standard protocol surveys also show greater variation in final count estimates between each round (**Appendix 6**). There were not enough observations of other rail species to analyze our results at all sites, we only detected Virginia rail during the national protocol surveys. Further analysis of these results is needed and will be completed in a joint effort between participating partners in 2013. However initial results indicate an increased detection probability when using the National protocol and eventual transition to the National survey method will allow for better estimates of abundance and population trends for the California clapper rail.

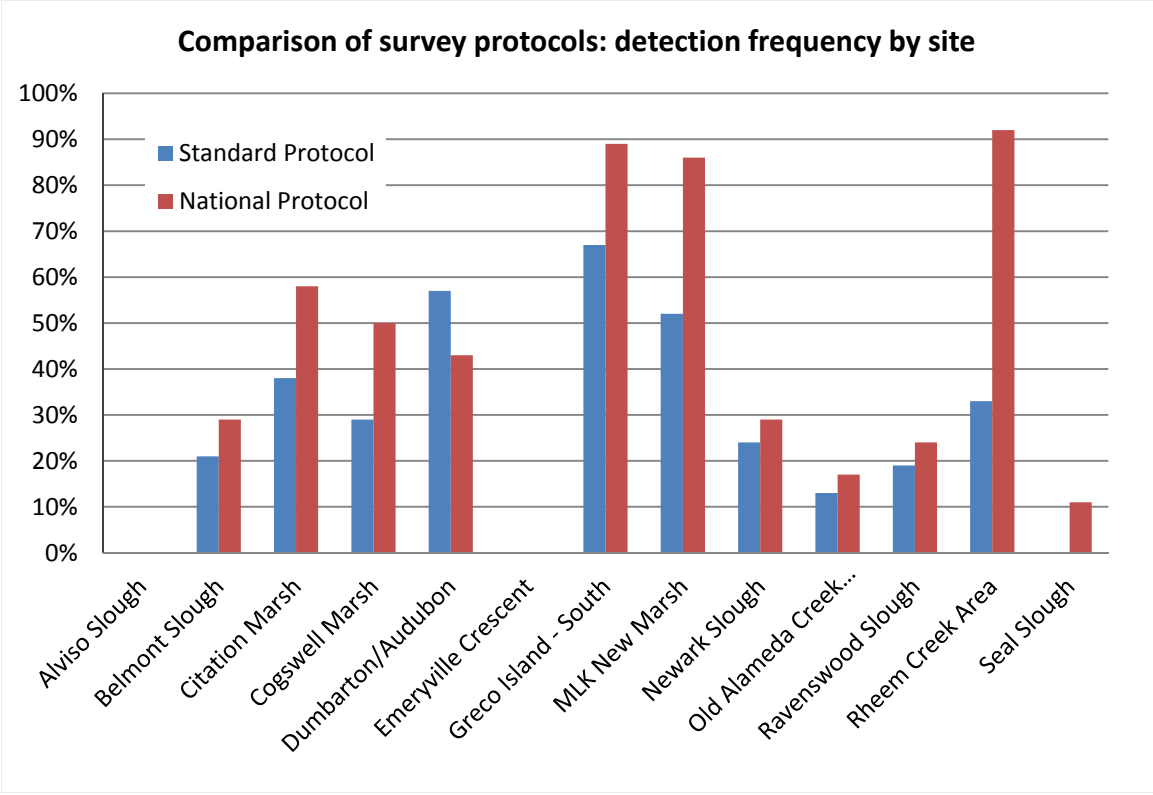

Figure 17. Comparison of the detection frequency between the two different survey methods. The detection frequency is defined as the number of station visits when clapper rails were detected out of the total number of station visits.

5. DISCUSSION

Recent analysis by PRBO of clapper rail survey data from 2005 to 2011 indicate that the steep declines in the California clapper rail population seen from 2007 to 2009 may be leveling off (Liu et al. 2012). Although this analysis excludes the most recent data from 2012, the trend appears to continue in 2012. In fact, counts at many of the larger marshes in the south bay increased in 2012 over previous years, notably in the Dumbarton Bridge South and San Mateo Regions.

Ongoing *Spartina* control by the ISP has significantly reduced the cover of non-native *Spartina* throughout the Estuary. At most sites, hybrid *Spartina* is so reduced that it provides little in the way of habitat for clapper rails. Notable exceptions to the decreasing trend in non-native *Spartina* cover include sites which were not treated in 2011 due to concerns over potential loss of clapper rail habitat provided by hybrid *Spartina*. Most of these sites have little native vegetation to support clapper rail in the absence of non-native *Spartina*.

ISP has begun a revegetation program to help rehabilitate marshes that were heavily impacted by the *Spartina* invasion. These efforts are aimed at reintroducing *Grindelia stricta* and native *Spartina foliosa* to sites where extirpated or greatly reduced by *Spartina* invasion. However, opportunities for revegetation are limited at sites where hybrid *Spartina* is not being controlled, the same sites that would be most benefitted. This impasse is most pronounced in the San Leandro Bay, where *Spartina* dominates small fragmented marshes and opportunities for revegetation are limited. In time, ISP plans to continue control work at these sites, but clapper rail numbers are likely to decline through the transition of these marshes from non-native *Spartina* cover to native vegetation when *Spartina* treatment resumes.

Continued monitoring of California clapper rails is necessary to determine how populations will stabilize in the wake of *Spartina* eradication. Additionally, ongoing surveys will provide a baseline population as large expanses of tidal wetlands are restored in the near future. Research is needed to identify: (1) the characteristics of high quality native clapper rail and (2) the methods of creating these features in new and existing restoration projects throughout the Bay.

ISP is currently working to analyze clapper rail survey data and habitat data to identify factors that contribute to imperfect detection. These analyses will be incorporated into an occupancy model to determine the habitat relationships of the California clapper rail at ISP sites. Results of our analysis will be used to monitor changes in clapper rail abundance over time at marshes undergoing non-native *Spartina* control. In turn, these results can be used to better inform stakeholders on evaluating management decisions.

Finally, early evidence from the pilot project suggests that the national protocol is effective at increasing the detection probability of clapper rails, results echoed in research conducted by Conway et al (2011). The increase in detection probability will lead to better estimates of clapper rail populations if the protocol is employed Estuary-wide. However further analysis is necessary to adequately model the differences between the two methods in order to eventually transition to the national protocol.

6. PERMITS

Surveys were conducted under the authority of U.S. Fish and Wildlife Service permit TE118356-0 and a Memorandum of Understanding with the California Department of Fish and Game. Surveys were required by and conducted pursuant to conditions of the Programmatic Formal Intra-Service Endangered Species Consultation on the San Francisco Estuary Invasive *Spartina* Project (1-1-03-F-0216 dated August 27, 2003), and subsequent additional formal intra-Service consultations on implementation of the San Francisco Estuary Invasive *Spartina* Project *Spartina* Control Program (1-1-04-F-0305 dated September 7, 2004, 1-1-05-F-0243 dated September 7, 2005, 810420-2008-F-1546 dated July 17, 2008, and 810420-2011-F-0686-3 dated September 23, 2011).
Permission for site access was granted by East Bay Regional Park District, the City of San Leandro, California Department of Fish and Game, City of Mountain View, Mid-Peninsula Regional Open Space District, Redwood City Marina, WestPoint Harbor, SFO International Airport, Richardson Bay Audubon Center, and Don Edwards San Francisco Bay National Wildlife Refuge.

7. REFERENCES

Albertson, J.D., and J.G. Evens. 2000. California clapper rail (*Rallus longirostris obsoletus*). In: Olofson, P.R. (Editor). 2000. Baylands Ecosystem Species and Community Profiles: life histories and environmental requirements of key plants, fish, and wildlife. Goals Project (Baylands Ecosystem Habitat Goals), San Francisco Bay Regional Water Quality Control Board, Oakland, Calif.

Conway, C.J., C. Sulzman, and B.E. Raulston. 2004. Factors Affecting Detection Probability of California Black Rails. Journal of Wildlife Management 68(2):360-370.

Conway, C. J. 2011. Standardized North American Marsh Bird Monitoring Protocol. Waterbirds, 34(3):319–3 46.

Evens, J. 2011. Benicia State Recreation Area, Southampton Bay Natural Preserve Endangered Species and Tidal Marsh Recovery: *Lepidium latifolium* Control Project Protocol-level nesting season surveys for California Clapper Rail and California Black Rail. Point Reyes Station: Avocet Research Associates. Report to California State Parks: Diablo Vista District.

Foin, T.C., E.J. Garcia, R.E. Gill, S.D. Culberson, and J.N. Collins. 1997. Recovery strategies for the California clapper rail (*Rallus longirostris obsoletus*) in the heavily-urbanized San Francisco estuarine ecosystem. Landscape and Urban Planning 38:229-243.

Liu, L., J. Wood, N. Nur, D. Stralberg, and M. Herzog. 2009. California Clapper Rail (*Rallus longirostris obsoletus*) Population monitoring: 2005-2008. PRBO Conservation Science Report to California Department of Fish and Game.

Schwarzbach, S.E., J.D. Henderson, C.M. Thomas, and J.D. Albertson. 2001. Organochlorine Concentrations and Eggshell Thickness in Failed Eggs of the California Clapper Rail from South San Francisco Bay. The Condor 103:620-624.

Schwarzbach, S.E., J.D. Albertson, and C.M. Thomas. 2006. Effects of predation, flooding, and contamination on reproductive success of California Clapper Rails (Rallus longirostris obsoletus) in San Francisco Bay. Auk 123:45-60.Conway, C.J. 2005. Standardized North American Marsh Bird Monitoring Protocols. Wildlife Research Report #2005-04. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

SFEI (San Francisco Estuary Institute). 2002. Bay Area EcoAtlas 1.50 beta 4 (http://www.sfei.org).

Wood, J, L. Liu, and N. Nur. 2011a. Endangered Species: Clapper Rail. In: Pitkin, M. and Wood, J. (Editors). 2011. The State of the Birds, San Francisco Bay. PRBO Conservation Science and the San Francisco Bay Joint Venture.

Wood, J. “Clapper Rail Population Trends and Modeling.” 2011b. 2011 Annual Clapper Rail Meeting. PRBO Conservation Science, Petaluma, CA. 5 December 2011. Presentation.

APPENDIX 1: Standard Survey Protocols for California Clapper Rails in the San Francisco Estuary

San Francisco Estuary Invasive *Spartina* Project
California Clapper Rail Survey Protocols

General Survey Requirements:

1) *Permits*. Obtain required survey permits: USFWS Endangered Species Permit, ESA Section 10(a)(1)(A); California DFG permit (i.e. Memorandum of Understanding); site-specific permissions (e.g., Special Use Permit from a NWR).
2) *Training.* Observers must be trained to identify clapper rail calls and distinguish CLRA calls from other marsh bird species (see Rail Training document, April 2004). Observers must also be trained to minimize disturbance while conducting surveys (see Walking in the Marsh document, April 2004).
3) *Tides and moon phase*. Conduct surveys when tidal sloughs are less than bank full, <4.5-ft NGVD at the nearest tide station. Tide height at bank full will vary by site. Avoid high (flood) tides. Full moon periods should be avoided during active surveys when tape playback is utilized, as birds may be attracted out of cover or a response may be elicited, increasing the likelihood of predation. There is also evidence of reduced calling rates during full moon periods.
4) *Survey Timing*. Morning surveys should be initiated 1 hour before sunrise and extended no more than 1.5 hours after sunrise; evening surveys should begin 1 hour prior to sunset and extend no more than 1 hour following sunset. Surveys at a particular location should be spaced at least 1 week apart and should be conducted at both sunrise and sunset.
5) *Weather*. Record wind velocities and weather; conduct surveys at winds <10 mph; do not conduct surveys during heavy rainfall.
6) *Seasonality*. Conduct surveys between January 15 and mid-April.
7) *Survey Stations*. Stations should be spaced approximately 200m apart. Stations should be placed on boardwalks or levee tops when possible to minimize disturbance. When surveys are conducted within a marsh, stations should be placed away from slough/channel edges to minimize disturbance to rail species.
8) *Data collection*. All rail vocalizations should be recorded, noting the call type, location, and time. Locations where rails are detected should be plotted on a map during the survey with numbered reference codes that correspond to detections on the datasheet. The call types should be coded as follows:

Call Code	Call Description	Number of Birds Indicated*
C	Clapper/clatter by one individual	1-2 birds
D	"Duet"- two individuals clattering simultaneously	2 or more birds, depending on situation
K	"kek"	1-2 birds
AK	agitated "kek"	1-2 birds
KH	"kek-hurrah"	1-2 birds
B	"kek-burr"	1-2 birds
V	Visual sighting	1-2 birds per sighting
SK	"squawk"	1-2 birds
SC	"screech"	1-2 birds
CH	"chur"	1-2 birds
P	"purr"	1-2 birds

* See data interpretation section below for more details about determining number of birds per detection type.

If the bird was definitely or possibly previously detected, e.g., as part of a pair, make this clear on the datasheet. Make a note when birds were detected simultaneously or nearly so, to verify that they were separate individuals. Calls of other rail species should also be recorded as above, with species clearly marked.

9) *Disturbance*. Record all information on disturbance (e.g., predator sightings or boats) detected during surveys.

10) Review the WRMP CLRA protocol (Evens 2002) for other general information (http://www.wrmp.org/docs/protocols/Wetland%20Birds.pdf, p.21 Rails). Defer to the requirements listed above if they are more restrictive than the WRMP protocol.

Survey Specifics – Standard Protocol Types

Type	Common Protocol Name	Description
A	Standard USFWS Transect Survey	*As described in Albertson & Downard, 2004 and Spautz 2005*. Used for linear sites and for sites with low to medium rail density. One or more observers move from station to station, remaining at each station for 10 minutes. 3 survey rounds, with recording played at end of 3rd round if no prior detections.
B	Standing or Stationary Survey (not used in 2006)	*As described in Albertson & Downard, 2004 and Spautz 2005*. Used for non-linear sites with high rail density. Requires one person at each station for 1½ hour. Typically 3 survey rounds, with recording played at end of 3rd round if no prior detections.
C	ISP-Modified Transect Survey	*Originally described in Zaremba & Albertson, 2004*; modified in Spautz & Albertson 2006. Used to determine presence or absence of CLRA at sites with low potential for CLRA presence, where *Spartina* control activities are planned. Same as Type A, except recording is played from first survey round, and surveys are discontinued upon detection.
D	DENWR-Modified Transect Survey (Rough Density)	Used by DENWR biologist in narrow strip marshes with medium to high rail density - Similar to Type C, except densities are extrapolated by Refuge biologist.
E	Winter High Tide Survey	*Described by EBRPD pers. comm*. CLRA are flushed out of marsh habitat by airboat and counted during winter high tide.
F	Preliminary Habitat Suitability Assessment	Quick assessment by CLRA biologist to determine if suitable CLRA habitat is present; if habitat is suitable, a call count survey protocol C is typically conducted.

Protocol A. The Protocol A transect survey is suitable for linear sites and for sites with low to medium rail density. Surveys as sites with high clapper rail density should use "Protocol B" – the standing or stationary survey protocol described by Albertson & Downard 2004 and Spautz 2005.

The transect survey may be performed by one or two observers. Listening stations are established at approximately 200 meter intervals along a transect, preferably along the edge of the marsh. The first two of three surveys are passive (listening) for 10-minutes at each station. On the third survey, if a clapper rail was not previously detected within 200 meters of a listening station during the two previous passive surveys or incidentally within the season, recorded calls are played, according to the "*Recorded Call Playback Procedure*" described below. If a clapper rail has been previously detected within 200 meters of a listening station, the third survey should also be passive. There should be a minimum of one week between surveys.

Protocol B. The Protocol B stationary survey is suitable for larger sites with high clapper rail density, such as Faber-Laumeister, Palo Alto Baylands, Greco Island, Dumbarton Marsh and Arrowhead Marsh. Surveys at linear sites and sites with low to medium rail density should use "Protocol A" – the walking or transect survey protocol described by Albertson & Downard 2004 and Spautz 2005.

The Protocol B stationary survey requires a sufficient number of observers to have one person at each listening station. Listening stations are established along a grid or transect, with stations set apart by 200 meters or more. Observers are present at each station for an entire 1.5-hour survey period. When calls are recorded, the observer must take care to record the exact time and direction, and best estimate of the distance of the call, so that the data can be reconciled with other observers' data. Reconciliation of data from multiple observers must be planned and closely supervised by a scientist with expertise in field data interpretation.

Because this procedure is only implemented at sites with a high density of clapper rails, under most circumstances, the survey need only to be repeated twice in a season, with a minimum of one week between surveys. If survey conditions are unsatisfactory for part or all of a survey period, a third survey may be conducted.

The Protocol B stationary survey is a passive listening survey, and does not include playing of recorded calls.

Protocol C. Protocol C (ISP modified transect survey) was developed to allow the ISP to more efficiently confirm presence or absence of California clapper rails (clapper rails) at certain non-native *Spartina*-invaded sites, so that *Spartina* control could be undertaken at sites with no rails during rail nesting season. Protocol C surveys are implemented only at sites where the probability of clapper rail presence is relatively low, i.e., at sites where clapper rails have not been previously detected, but where marginally suitable habitat or other conditions suggest that rails may be present. Protocol C differs from Protocol A (USFWS standard transect survey) in that it allows the broadcasting of pre-recorded clapper rail vocalizations beginning on the initial round of surveys in order to elicit responses from birds in the marsh. If a clapper rail responds, the broadcast is immediately discontinued and not repeated on subsequent survey rounds at that station, and *Spartina* control at that location is postponed until times authorized by the USFWS Section 7 Biological Opinion. In some cases, if clapper rail presence is determined using Protocol C, the ISP may choose to complete the survey using Protocol A to determine the number of birds present at the site.

The suitability of using Protocol C is determined based on whether clapper rails have been previously detected at the site, and whether conditions at the site suggest that clapper rails may be present. The ISP regularly reviews clapper rail records from all known sources, including PRBO Conservation Science, Avocet Research Associates, U.S. Fish and Wildlife Service, San Francisco Bay Bird Observatory, California Department of Fish and Game, East Bay Regional Parks District, and other reliable sources, to identify locations where clapper rails have been detected in the past. Also, the ISP evaluates all planned *Spartina* treatment sites for potential habitat, and conducts habitat assessment

surveys (Protocol F) at any locations that are thought to be potentially, albeit marginally, suitable clapper rail habitat. If the ISP plans to do *Spartina* control at a location where (1) the collective records do not indicate clapper rails have been detected for the prior two years, and (2) the habitat at the site is determined to be at least marginally sufficient for clapper rails, then a Protocol C survey would be performed. If the ISP requires clapper rail data at locations where clapper rail presence was previously confirmed within the prior two years, it would use Protocol A (Standard USFWS transect), rather than Protocol C. Generally speaking, Protocol C surveys are conducted at sites that have a low probability of clapper rail presence.

Protocol F. The San Francisco Estuary Invasive *Spartina* Project (ISP) is required (under the USFWS Biological Opinion dated September 2005) to conduct surveys for California clapper rails (*Rallus longirostris obsoletus*) to determine clapper rail presence or absence prior to treatment of non-native *Spartina*. Sites that are clearly insufficient to support clapper rails, e.g., stretches of concrete rip-rap with a scattering of small non-native *Spartina* clones, do not require clapper rail surveys. However, sites requiring *Spartina* control exhibit a continuum of habitat characteristics, many of which are documented clapper rail habitat requirements (e.g., extensive channels for foraging and vegetated upper marsh for refuge during high tides). This makes it difficult in some cases to determine whether the habitat at the site is of sufficiently high quality to require a call count survey. In 2005, the ISP developed a standardized method to document the decision as to whether or not a clapper rail survey was required (Protocol F).

ISP staff consulted with Joy Albertson and Jules Evens to develop a list of required habitat elements for clapper rails based on field knowledge and published sources. This information was used to develop a field checklist to assess the habitat using multiple criteria and to document the decision as to whether the marsh will require a formal clapper rail call count survey. The habitat assessment is typically completed at sites where clapper rails have previously not been documented. Protocol F may also be employed in sites with historic clapper rail presence, but where there have been no detections over the prior two years of formal survey. This scenario may become more prevalent as marshes once fully invaded by hybrid *Spartina* are treated and the resulting landscape is no longer suitable to support rail populations.

The process of determining whether the site is of sufficient quality to require a call count survey is based on a cumulative score of positive characteristics. Patches with no necessary habitat elements are considered very poor habitat in which clapper rail use is "highly unlikely," and require no further clapper rail survey; such sites are determined to be available for early non-native *Spartina* treatment. If the site is poor but is geographically near enough to good habitat or known rail habitat to potentially provide habitat for at least some clapper rail activities (such as foraging or shelter), it will require a call count survey. Potentially good habitat with at least two positive characteristics will also be likely to require a call count survey, but this will be site-dependent. Possibly good habitat or likely good habitat (with at least four or six characteristics, respectively) will require a call count survey.

If call count surveys are required, the biologist will generally recommend using clapper rail call count survey protocol "C", which is conducted at apparently low quality sites where clapper rails are not likely and have not been previously documented. However, it is possible that the site is of sufficiently high quality that clapper rails are at least moderately likely and a standard call count protocol "A" survey will be recommended.

Habitat characteristics documented to be associated with California clapper rails and included on the habitat assessment datasheet include the following:

1. Young or mature restoration site (at least 50% vegetated)
2. Upper marsh vegetation present
3. Vegetated levee slopes
4. Marsh patch size > 10 ha
5. Closer than 500 m to nearest marsh with documented clapper rail presence
6. Fully tidal
7. Saline
8. High proportion of *Salicornia virginica*, tall hybrid *Spartina* clones, and/or *Grindelia stricta* cover
9. At least a few second and third order channels, or highly channelized

Habitat characteristics associated with California clapper rail absence and included on the habitat assessment datasheet as negative characteristics include the following:

1. New restoration site < 50% vegetated
2. Upper marsh vegetation absent
3. Levee slopes unvegetated
4. Small marsh patch size (< 1 ha)
5. Distance to nearest known marsh with clapper rails > 1000 m
6. Sparse vegetation in rip-rap
7. Highly muted tidal regime or non-tidal
8. Freshwater

Recorded Call Playback Procedure

A standardized recording of clapper rail calls should be obtained from USFWS. The recording should include a combination of clapper/clatter and duet calls, and there should be at least four complete calls with at least 5 seconds of silence between calls. The recording should be of good quality, and should be played at a volume of 80-90 dB at 1-meter distance from the speaker. A digital sound level meter should be used to calibrate the playback device.

The survey should begin with an initial 5-minute passive listening period, followed by 1-minute of clapper rail calls, and completed with a 4-minute passive listening period (10-minutes/survey). Tape playbacks should be broadcast in all directions over the marsh at a station. Assume rails can hear tapes at distances of ≤200 m.

Note: Only play recorded clapper rail calls at stations when you are certain rails have not yet been detected within a 200-m radius. As soon as a clapper rail is detected, stop the recording.

Data Interpretation and Data Analysis

Use the following key to determine how many birds to record for each detection type. Use your "field" judgment to avoid redundancy (overlap) and interpret uncertainty as a range. Keep in mind the part of the breeding season in which your survey occurs.

Detection type	Code	Number of birds	Description	Notes and Exceptions
Clatter	C	1 - 2	Primary territorial call. Rapid series of kek notes, often trailing off at the end.	• Usually clattering individuals are paired. Often it's difficult to determine whether one or two birds are calling, if completely synchronized; thus, the range of 1-2 birds. • Example scenario: at the end of a survey session you have 4 distinct duets, 3 single clatters away from duets and away from one another. The estimate for breeding birds would be 11-14 (# duets x 2 = 8 + 3-6 birds represented by clatters).
Duet clatter	D	2	Two bird clattering simultaneously.	• Usually given by a pair, or less often, neighboring territorial males (J. Evens pers. obs. 2005). • When chorusing birds are masking one another and you are uncertain whether it was one duet or two, record as 1-2 duets (1-2 pairs) or 2-4 clatters. Again, interpret uncertainty as a range.
Kek	K	1-2	Single sharp "kek" call, given singly or in series, with significant space between calls (as compared to clatter, which is very rapid).	• Given by males, most often when unmated or prior to setting up pair bond, thus is most typically heard early in the season. However, can be given by a mated male throughout the breeding season, thus the range of 1-2 birds. • Sometimes paired/breeding birds make random keks or kek-burrs intermingled with clatters, especially at the beginning of the breeding season. If you hear a single kek followed by a duet in the same location, the kekking individual is likely part of the duet pair and would not be counted separately.
Agitated Kek	AK	1-2	As above but higher pitched, rougher, and with what can be interpreted as an element of alarm. Mid-way between kek and squawk or screech.	• As above, the call may indicate either an unmated or mated male, thus the range of 1-2 birds.

Detection type	Code	Number of birds	Description	Notes and Exceptions
Kek-burr	B	1-2	One or several rapid "kek" calls followed by a more attenuated, "burrrr". Often repeated constantly over many minutes, and can be heard about 1 km away, depending on conditions.	• Given by female clapper rails, primarily during pair bond formation or when fertile and soliciting a copulation with her mate, thus, it is most typically heard early in the season. The call is not likely to be given when she is incubating. Later in the season, it may be given when a nest has failed and the female is beginning another nesting attempt. The call may indicate either an unmated or mated female, thus the range of 1-2 birds. • A single kek-burr followed by a duet: the individual is likely part of the duet pair and would not be counted separately.
Visual	V	1- 2		• Clapper rails are most often seen when foraging along tidal channel banks, often near the shelter of overhanging vegetation. They are often seen crossing channels, and regularly swim across open water within a channel. • A sighting of one bird may indicate the presence of a pair; thus record as 1 – 2 birds.
The following descriptions were not included in Albertson & Downard 2004 or Spautz 2005, but are provided here for completeness.				
Kek-hurrah	KH	1-2	Series of "kek" calls attenuatingdrastically in pace and pitch toward the end	• Thought to be primarily given by males
Squawk	SK	1-2	More highly agitated than an agitated kek,	• Typically given only once as an alarm call. Bird may later make other vocalizations.
Screech	SC	1-2	More rare than a squawk. Like a squawk but even more high-pitched.	• Typically given only once as an alarm call.
Churr	CH	1-2	Similar to the last syllable in a kek-bur call	• Typically given by a female.
Purr	P	1-2	Very soft, like churr or burr.	• Typically given by a female at the nest.

APPENDIX 2: National Marsh Bird Monitoring Protocol (Pilot Project)

San Francisco Estuary Marsh Bird Survey Protocol

(Version 2012.4)

Based on the North American Marsh Bird Monitoring Protocols by Conway (2011)

Summary

(1) **Focal species** The marsh bird species targeted for data collection are known as "focal species." In the San Francisco Estuary, these species include: California Clapper Rail (CLRA), California Black Rail (BLRA), Sora (SORA), Virginia Rail (VIRA), American Bittern (AMBI), American Coot (AMCO), Common Moorhen (COMO), Pied-billed Grebe (PBGR), Least Bittern (LEBI) and Yellow Rail (YERA).

(2) **Survey routes** For new routes, if a marsh is large enough to accommodate 7 or 8 survey points with 400 m spacing, such spacing is preferred. However, for small to moderate-sized marshes, survey points spaced at 200 m is permissible. In areas where survey routes have already been established and surveyed in past years, we recommend retaining established survey routes with original point spacing. Survey points should be placed on boardwalks or levee tops when possible to minimize disturbance.

(3) **Survey timing** Morning surveys should be initiated 1 hour before sunrise and should not extend more than 1 hour after sunrise. Evening surveys should begin prior to sunset, no more than 1 hr before, and extend no more than 1 hour following sunset. At least three surveys are conducted at each survey point annually between January 15-April 15. Surveys at a site should be spaced at least 1 week apart and may be conducted in the morning or evening.

(4) **Tide and weather restrictions** Surveys will be conducted when tidal sloughs are less than bank full. Tide height at bank full will vary by site. Surveys should only be conducted when wind speed is <16 km/hr (<10 mi/hr), and not during periods of sustained rain or heavy fog.

(5) **Recording environmental data** Before the 10-minute call-broadcast sequence, surveyors will record wind speed, temperature, sky condition and ambient noise using a sound level meter. Surveyors will note disturbances (e.g., predator sightings, dogs, boats, etc.) in the Comments column.

(6) **Recording marsh bird data** Surveyors will record all focal species detected during: (1) a 5-minute passive period prior to broadcasting calls; and (2) during a 5-minute period in which prerecorded vocalizations of BLRA, CLRA, SORA, VIRA and AMBI are broadcast into the marsh. Surveyors will note the call type, distance, direction, and time of each detection. Focal species are recorded in 1-minute time segments on a standard data sheet (see attached). The entire 10-minute survey sequence is played on each visit, whether focal marsh birds are detected or not. Playback will be stopped immediately if a predator approaches within 100 m of a marsh bird.

(7) **Broadcast equipment and placement** The broadcast player is placed upright on the ground (or on the bow of the boat) and pointed in the direction of the greatest amount of marsh habitat. Sound pressure should be 80-90 dB at 1 m in front of the speaker. Surveyors stand 2 m to one side of the speaker while listening for vocal responses.

(8) **Training** Observers must be trained to identify marsh bird calls for all focal species (see Rail Training document, April 2004). Observers must also be trained to minimize disturbance while conducting surveys (see Walking in the Marsh document, April 2004).

(9) **Permits** Surveyors are required to obtain survey permits prior to surveying for Clapper Rails. These permits include: USFWS Endangered Species Permit, ESA Section 10(a)(1)(A); California DFG permit (i.e., Memorandum of Understanding); and site-specific permissions (e.g., Special Use Permit from a National Wildlife Refuge).

Specifics of the survey protocol

Objectives

This survey protocol is intended to provide guidance to individuals conducting marsh bird surveys in the San Francisco Estuary in order to meet the following objectives: (1) to satisfy legal requirements for monitoring population trends of threatened and endangered species; (2) to estimate population trends of other marsh bird species of interest; (3) to estimate or compare density of marsh birds among management units, wetlands or regions; (4) to learn about marsh bird-habitat relationships; and (5) to evaluate the effects of restoration or other management actions on marsh birds. This standardized monitoring protocol facilitates data sharing among San Francisco Estuary partners and is compatible with the Standardized North American Marsh Bird Monitoring Protocol (Conway 2011).

Density, abundance, and detection probability

This protocol defines abundance as the total number of birds within a defined area of interest. Density is defined as abundance divided by area, or the number of birds/ha of wetland (or birds/ha of emergent vegetation within a wetland) during one season. Surveys rarely count all individuals present in the sampling area because detection probability is typically less than 100%. Due to imperfect detection rates, estimates of abundance or density rely upon estimates of detection probability, and either: (1) a consistent positive correlation between the number of individuals detected during a survey and the number of individuals actually present in the area sampled (i.e., low spatial and temporal variation in detection probability), or (2) incorporating environmental covariates into the estimation process that effectively control for most of the variation in detection probability. Accounting for detection probability allows for validation of counts based on call-broadcast surveys for focal marsh bird species. Detection probability can be estimated using data generated by this protocol in three ways: (1) distance sampling (Thomas et al. 2010); (2) double-observer sampling (Riddle et al. 2010); and (3) time-of-detection or removal models (Alldredge et al. 2007).

Focal species

The marsh bird species targeted for data collection are termed “focal species.” In the San Francisco Estuary, the focal species include: California Clapper Rail (CLRA), California Black Rail (BLRA), Sora (SORA), Virginia Rail (VIRA), American Bittern (AMBI), American Coot (AMCO), Common Moorhen (COMO), Pied-billed Grebe (PBGR), Least Bittern (LEBI) and Yellow Rail (YERA).

Survey routes

A survey route is a grouping of points that are surveyed during the same morning (or evening) survey window. All survey points should belong to one (and only one) survey route. The number of points to include on a particular survey route can vary among routes based on the number of survey points that one surveyor can get done in a morning (or evening) survey window (see *Time of day for surveys*). Typically, a surveyor can only survey a maximum of 8 points in a morning or evening survey window. All the survey points that make up one survey route do not have to be associated with the same marsh. Including fewer points per survey route and surveying an additional morning/evening (rather than fewer routes with lots of points) will typically result in more detections.

Once a surveyor selects the direction in which they conduct a particular survey route, vary the direction on subsequent visits (e.g., survey the points along route #1 in descending order every other visit). Varying the direction of the route will assure that each survey point is not completed at the same time of day during each survey, allowing detection probability to be modeled as a function of time of day and/or tidal stage.

Location of survey points

When choosing a location for a survey point on land, points should be located along existing access routes such as boardwalks or levee tops, when possible, to minimize disturbance. Each survey point should receive a unique identification number. The GPS coordinates of each survey point should be recorded (in UTM, NAD 83, Zone 10).

Point spacing

For setting up new routes, we recommend 400m between adjacent survey points to reduce the probability of double counting individual birds and to increase the total area covered by monitoring efforts. If a marsh is large enough to accommodate 7 or 8 survey points with 400 m spacing, such spacing is preferred. However, for small to moderate-sized marshes or marsh units, it is more desirable to include more survey points (i.e., 5 to 8) with 200 m spacing than to include only 2 or 3 points spaced at 400 m. Organizations that prefer closer point spacing for some local reason should space points by an interval that is easily divisible by 400m (i.e., 200m, 100m). Analysts can choose to use data only from a subset of points (those that are 400m apart) at that particular site from the shared (pooled) dataset if they choose to do so. In areas where survey routes have already been established and surveyed in past years, retain the original point spacing; do not delete, ignore, or move existing survey points even if spacing between adjacent points is different than 400m.

What if area around an existing point is no longer suitable marsh bird habitat?

Original survey points are never dropped from the survey and are always visited in subsequent years. If no suitable habitat is present at an existing survey point during a particular year (i.e., due to drought or change in water flow), then the surveyors should still make an entry for that point on the datasheet but write in the *Comments* column: “No survey conducted because suitable habitat is not present.” If surveyors do not conduct a survey at one or more existing points, they should record in the *Comments* column the reason why a survey was not conducted at those points, for example:

(1) lack of suitable habitat due to temporary change such as flooding, drought, mowing, etc.

(2) lack of suitable habitat due to permanent change.

(3) survey not attempted due to logistical reasons.

Time of day for surveys

Surveys can either be conducted in the morning or evening. Morning surveys should be initiated 1 hour before sunrise and **extend no more than 1 hour after sunrise (every effort should be taken not to survey more than 1 hr after sunrise)**. Evening surveys should begin 1 hour prior to sunset and extend no more than 1 hour following sunset. The best period for detection of California Clapper Rails centers around 15 min before sunrise and around 15 min after sunset. This should be taken into account if the survey period is less than the full 120 min. Thus, if the survey period is only 90 min for a morning survey, it is better to survey from 60 min before sunrise to 30 min after sunrise than the converse. Similarly, if the survey period is only 90 min for an evening survey, it is better to survey from 30 min before sunset until 60 min after sunset than the converse.

Effort should be made to visit each survey route in both the morning and the evening each year. Including both morning and evening surveys along a given survey route allows detection probability to be modeled with morning/evening as a covariate.

Number of surveys per year and seasonal timing of surveys

There should be at least three surveys conducted at each survey route annually between January 15 and April 15. If possible, a survey route should be surveyed once in each of the following three periods and at least one week apart: (1) January 15 - February 15; (2) February 15 - March 15; and (3) March 15 - April 15. If this spacing is not possible, survey routes should be revisited at least one week apart.

Tidal stage and weather restrictions

Conduct surveys when tidal sloughs are less than bank full. Tide height at bank full will vary by site. Sites should never be surveyed when the marsh plain is flooded.

Surveys should only be conducted when wind speed is <16 km/hr, and not during periods of sustained rain or heavy fog. Even winds <16 km/hr (<10 mi/hr) affect the detection probability of marsh birds. Surveyors should postpone surveys if they believe winds are affecting calling probability of marsh birds. Recommendations for conducting surveys in very windy locations include:

(1) Determine what time(s) of day have the least wind in your area. The daily survey windows in the protocol are recommendations; survey times should be modified under conditions where wind regularly affects vocalization frequency or observer detection rates. The important thing is that surveys are conducted during the same daily time window each year at a particular location, and the survey windows at a particular location should be the time of day or night that has the highest detection probability for your target species in your area. In some locations, surveys conducted after sunset (or before sunrise) may have higher detection probability compared to the morning and evening survey windows recommended in the protocol because strong winds are less frequent during the middle of the night. In these situations, surveys should be conducted at night.

(2) Try to be flexible with your schedule if you can. For example, plan to conduct a survey on a particular day but postpone to the following day if it is too windy, and keep postponing until you get a day that meets the acceptable weather criteria to complete the survey. If wind speed increases to above 16 km/hr during the survey (or sustained rain begins while the survey is already underway), surveyors should stop the survey and repeat the entire survey route another day (i.e., don't just go back and repeat the remaining points on the route).

The call-broadcast sequence

The call-broadcast sequence includes a 5-minute passive period and a 5-minute period with recorded vocalizations of the following focal marsh birds: Black Rail, Clapper Rail, Sora, Virginia Rail, and American Bittern, in that order. Locally recorded CLRA, BLRA and VIRA calls and other non-local calls were used were used to create the call-broadcast sequence MP3 file. The MP3 file includes 30 seconds of calls for each of the focal marsh bird species interspersed with 30 seconds of silence between each species' calls. The 30 seconds of calls consist of a series of the most common calls for that species interspersed with approximately 5 seconds of silence.

The entire survey sequence is:

- 5 minutes of silence (a verbal statement at the end of each minute is given to alert surveyors);
- 30 seconds of Black Rail (BLRA) calls;
- 30 seconds of silence;
- 30 seconds of Clapper Rail (CLRA) calls;
- 30 seconds of silence;
- 30 seconds of Sora (SORA) calls;
- 30 seconds of silence;
- 30 seconds of Virginia Rail (VIRA) calls;
- 30 seconds of silence;
- 30 seconds of American Bittern (AMBI) calls;
- 30 seconds of silence; and
- Verbal "stop" at end of the final 30 seconds of silence so that surveyors know when to stop playback and the survey at that point.

The entire 10-minute survey sequence is played on each visit without interruption, whether focal marsh birds are detected or not. The only exception to this is if the surveyor reasonably concludes that call-broadcast may endanger a bird (e.g., the surveyor notices that a predator is within 100 m of the survey point or of an individual of a focal species). In this case, the surveyor should immediately stop playback and instead conduct a passive survey. In the *Comments* section, the surveyor should note that playback was stopped or not attempted.

Broadcast equipment and placement

The broadcast player is placed upright on the ground 2 m from and at the same elevation as the surveyor's feet (or on the bow of the boat). Sound pressure should be 80-90 dB at 1 m in front of the speaker. A sound-level meter is used to adjust volume of the broadcast player at the beginning of each day, and surveyors should always carry spare fresh batteries. Sound quality should not distort when volume on the broadcast equipment reaches 80-90 dB. If the ground is wet, the speaker is placed on an object as close to the ground as possible. Surveyors stand 2 m to one side of the speaker while listening for vocal responses (standing too close to the speaker can reduce the surveyor's ability to hear calling birds). Surveyors point the speaker toward the center of the marsh and do not rotate the speaker during the call-broadcast survey. Speakers should be pointed in the same direction for all replicate surveys. At points where it is not obvious which direction to point the speakers (i.e., on a road or in a canal bisecting two marshes), surveyors should record the direction of the speakers at each point on a map and on

their data sheets and refer to this information on all replicate surveys. See the *Recommended Equipment List* below for recommended amplified speakers.

Filling out the data sheet

Surveyors should record the date, name of the route and observers at the top of the data sheet. The month is written out, or a 3-letter acronym is used, to avoid confusion between day and month. The name of the survey route (marsh site) and target site code are also recorded. The full names of all persons present during the survey are recorded. If more than one person is present, the person who recorded the data and all persons that helped identify calling birds are recorded. Surveyors record whether or not the survey is a multiple-observer survey (survey where different individuals each record observations on separate data sheets to estimate detection probability).

Recording environmental data

After arriving at a survey point but before beginning the 10-minute call-broadcast sequence, surveyors should record information on weather conditions (wind speed, temperature, sky condition) and ambient nosie.

Recording weather conditions

Surveyors record wind speed, ambient temperature and sky condition at each survey point before the beginning of the 10-min call-broadcast sequence. Record whether you measured the ambient temperature in degrees Celsius (˚C) or degrees Fahrenheit (˚F). Record wind speed with an anemometer in miles per hour (mph). We use the same sky condition codes as the North American Breeding Bird Survey (see below).

SKY CODES: (Enter these National Weather Service code numbers on data sheet)

0 - Clear or a few clouds

1 - Partly cloudy (scattered clouds) or variable sky

2 - Cloudy (broken) or overcast

3 - Sandstorm or dust storm, or drifting or blowing snow

4 - Fog or smoke or thick dust haze

5 - Drizzle

6 - Rain

7 - Snow or sleet (rain and snow mixed)

8 - Showers

9 - Thunderstorm (with or without precipitation)

Recording ambient noise level and disturbances

Surveyors record the level of background noise in decibels (dBA or dBC) at each survey point using a sound level meter (see *Recommended Equipment List*) before the beginning of the 10-min survey. Surveyors should turn on the sound level meter, set it to “slow,” and wait about 10 seconds for the meter to stabilize. Under the slow setting, the frequency of readings will be damped to smooth the noise out, making it easier to read. Then the surveyor should estimate the average reading over a 10-second period. The letters “A” or “C” designate a frequency-

response function that filters the sounds that are picked up by the microphone in the sound level meter. A frequency-response function, also called a weighting characteristic (meaning that some frequencies are given more weight or importance than others), can also be thought of as a tone control. It emphasizes or de-emphasizes sounds of certain pitches relative to others. The A weighting filters out the low frequencies and slightly emphasizes the upper middle frequencies around 2-3 kHz. By comparison, C-weighting is almost unweighted, without any filtering. A-weighting is used to measure hearing risk and for compliance with OSHA and MSHA regulations that specify permissible noise exposures in terms of a time-weighted average sound level or daily noise dose. C-weighting is used in conjunction with A-weighting (the dBA and dBC levels are compared) for certain computations involving computation of hearing protector attenuation. **We recommend using A-weighting for this protocol (dBA).** However, if your sound level meter only displays dBC, record the data and circle dBC for the units.

If the ambient noise level changes significantly during the survey (e.g., if a loud boat passes the survey point during minutes 6-7 of the survey), take a new sound level reading if you are able to, record it in the Notes, and later calculate a weighted average of the sound level for the entire 10-minute survey.

In addition to recording the ambient noise level with a sound level meter, enter a code for ambient noise in the final column of the data sheet. Categorize the background noise at each point on a scale from 0 to 4:

0 = no background noise during virtually all of the survey;

1 = faint background noise during at least half of the survey;

2 = moderate background noise (probably cannot hear some birds beyond 100m during >30 seconds of the survey);

3 = loud background noise (probably cannot hear some birds beyond 50m during >30 seconds of the survey); and

4 = intense background noise (probably cannot hear some birds beyond 25m during >30 seconds of the survey).

Surveyors record any notable disturbances to the focal species in the Notes section. Disturbances may include the presence of people, boats or dogs, for example. The presence of predators near the survey point should also be noted (harriers, cats, foxes, raccoons, coyotes, herons, egrets, etc.), and surveyors should not use call-broadcast if a predator is observed within 100 m of a marsh bird.

Recording marsh bird data

Recording detections of focal, broadcast species

When the surveyor is ready to start the call-broadcast portion of the survey, they write does the start time and begin the 10-minute call-broadcast sequence, which is played in its entirety. Detections of focal species should be recorded in one-minute time segments on the data sheet (i.e., each individual bird of these species will be recorded on a separate row on the datasheet). When an individual of a focal, broadcast species (CLRA, AMBI, BLRA, SORA or VIRA) is detected, the surveyor writes the species name in the "Species" column. The 4-letter acronym for the species can be used or the full species name. Put the call type code in each detection column in

which that individual bird is detected aurally and put an "V" in each column in which the individual is seen (including flying overhead). If a bird is both seen and heard, write the call code and "V." If multiple call types are heard, record the call codes for each vocalization type. NOTE: If a surveyor gets overwhelmed at a high-density station, they may elect to record 1's instead of call type codes in the detection columns.

Example: If an individual Clapper Rail gives a "grunt" during the first 1 minute of passive listening, put the call type code, in this case "G," in the first column. Regardless of whether that individual grunts once or many times during the first minute, you only put one "G" in the first column. If that same individual bird is still grunting during the second minute of passive listening, then also put a "G" in the second column. If the same individual "squawks" during the 30 seconds when Sora calls are being broadcast or the 30 seconds of silence immediately following the Sora sequence, write "sqk" in the column for "SORA – Min 8." If that same individual bird squawks AND grunts during the Virginia Rail minute, write "sqk G" in the column "VIRA – Min 9", and so on. Hence, if an individual bird is calling constantly throughout the survey period, you will have codes for the vocalizations in every column for that individual. If the individual is heard and seen, put the call code and a "V" in the appropriate column(s). If you hear a call of the same species but from a different individual (or from an individual of another species), you start a new row on the data sheet and follow the same protocol just described for this individual bird. Recording whether each individual bird is or is not detected during each 1-min segment allows detection probability to be estimated using time-of-detection models.

Estimating distance and direction to each focal bird

Surveyors estimate the distance from the survey point to each individual bird. The distance to each bird is estimated when the bird is first detected. Recording the distance to each individual allows the use of distance sampling to estimate density for each species in each habitat type. The distance at which most individuals are detected varies among the focal species. Surveyors are encouraged to use a range finder to help them determine the distance to specific landmarks surrounding each survey point, which will help estimate the distance to calling marsh birds. Other methods for improving one's ability to estimate distance include: (1) tying surveyors flagging at 50m and 100m away from each survey point in each cardinal direction; and (2) carrying aerial photos of the marsh with 50m-, 100m-, and 200m-radius circles drawn around each survey point. Surveyors should enter on the datasheet which of the following distance estimation aides they used: Unaided, Distance Markers, Range Finder, Range Finder and Maps, Maps or Aerial Photos, or Distance Not Recorded.

In addition, surveyors should estimate the direction to the focal bird using a compass, with declination set for the San Francisco Bay Area (see http://www.ngdc.noaa.gov/geomagmodels/struts/calcDeclination). This data can be used to plot the location of a bird on a map and will aid in distinguishing unique individuals.

Distinguishing multiple birds

Surveyors may have difficulty determining whether a call is coming from a new individual or an individual detected earlier at that survey point. Surveyors must often make this decision without seeing the bird by using their best judgment. In general, be conservative and assume that a call is from the same bird if the call came from the same general location (i.e., a similar direction and not too far from the location of the original call).

Some species of marsh birds give paired duets and surveyors can often distinguish pairs of birds during surveys. ALWAYS record both members of a pair **on their own individual row of the**

datasheet. Record "pair" in the Comments columns for both of the two birds that are thought to be members of a mated pair.

No birds or unknown birds

The number of rows filled out on the data sheet will differ among survey points and will correspond to the total number of individual focal marsh birds detected at each point. If no focal marsh birds are detected at a survey point, you should still have recorded the environmental data. If the surveyor hears a marsh bird but is unsure of its identity, the surveyor should write "unknown" in the Species column and record all data for this individual as described above. Surveyors should make a verbal description of the unknown call in the Comments column (e.g., soft "kak-kak-grr" - sounds like BLRA but harsher'). This is for the surveyor's own use (not entered into database) and will aid future identification of unknown calls if that call is heard repeatedly. If time permits, the surveyor can return to the point with another expert birder who may be able to help identify that "unknown" bird or with sound recording equipment so that they can make a recording of the call for identification.

Recording detections of focal, non-broadcast species

Whenever possible, focal, non-broadcast species (AMCO, COMO, LEBI, PBGR, YERA) are recorded in the same way as 'focal, broadcast species' above, but their calls are not broadcast during the call-broadcast portion of the survey.

Record types of calls given

Surveyors record all types of calls given by each marsh bird that is a focal species in the detection columns. The call type codes are provided on the data sheet and in Appendix A. Refer to the North American Marsh Bird Monitoring Program website to listen to examples of each common call type:

http://www.cals.arizona.edu/research/azfwru/NationalMarshBird/

Birds detected at a prior survey point or between points

If surveyors detect a new bird of a focal species immediately after the survey period at a particular point (or while walking between points), they should record these birds on a separate row and record "Y" in the "*Outside time?*" column. If a surveyor detects a focal bird during a survey and the surveyor believes that this is the same individual bird that was detected and recorded at a previous survey point (either during or outside the previous survey), the surveyor should record all the relevant data for that bird and then enter a "Y" in the "*Counted at other station?*" column on the datasheet. When in doubt, be conservative as to whether an individual bird detected at the current point was the same individual recorded at a previous point (i.e., record "Yes" when in doubt).

Recording whether focal birds are within the "target area"

One goal of this effort is to document the effects of management actions on marsh birds, but often times there may be adjacent areas that have undergone different management actions. This presents a problem if some birds detected at a survey point are within one area but others are within another area (with a different management history). In other words, some participants that use this protocol will have certain survey points that were located specifically to count birds within a certain "target area."

Example: Four points along a survey route were located with the intent to count marsh birds within "impoundment A" and five points along that same survey route were located with the intent to count marsh birds within "impoundment B." However, surveyors at these nine points detect birds both within these impoundments but also in adjacent areas outside these impoundments. We often would like to count all birds detected at each point, but also delineate which ones were within these impoundments. Hence, surveyors should record, to the best of their ability, whether each bird detected was or was not in their "target area" by recording a "Y" or "N" in the "*Outside site?*" column. In the example above, the "target area" is impoundment A for points 1-4 and the "target area" is impoundment B for points 5-9. If some (or all) of your points are associated with a "target area," the name of that target area should be identified in the database for each point.

Some participants may not have any "target area" associated with any of their survey points, and can therefore leave this column blank on the datasheet (and in the database).

What to do if the surveyor becomes overwhelmed with too many detections

When many birds are calling simultaneously, it can be difficult for the surveyor to: (1) decide whether they are hearing new individuals or previously-detected ones; (2) write new individuals on a new line of the datasheet; and (3) find the correct line where they wrote down previously detected birds. In these situations, here are a few comments, observations, and suggested remedies. First, individual surveyors do get better at this with practice even with relatively high numbers of calling birds at a point. However, everyone has a threshold when the numbers of calling marsh birds get too high at a particular point. This problem occurs more frequently when a surveyor has many species in their call-broadcast sequence (and hence many detection columns on their datasheet). A surveyor often does not know until after the survey has started at a particular point that he/she is becoming overwhelmed and is not effectively assigning the correct calls to the correct columns (individuals). Below is a list of solutions to this problem in decreasing order of preference:

(1) Surveyors can record 1's in the detection columns if they detect a focal marsh bird giving any vocalization in a given minute, rather than recording call type codes.

(2) For those focal species that are of lower management/conservation interest (e.g., American Coots, Common Moorhens, Pied-billed Grebes), surveyors can write down an estimate of the total number of individuals detected for that particular species at that point (e.g., write "AMCO (45)" in the Species column on one line of the data sheet) rather than recording one line per bird. It is important that surveyors record in the *Site Notes* section of the datasheet (and in the database) times when they were overwhelmed and could not record data for individual birds on separate rows of the data sheet (for focal species).

(3) Finally, surveyors can elect to reduce the number of focal species that are included in the survey. Species of lower management/conservation interest (e.g., American Coots, Common Moorhens, Pied-billed Grebes) can be dropped from the survey. If this is done, then the species code for the dropped species should be crossed out at the bottom of the data sheet in the call codes box.

Permits

Surveyors are required to obtain survey permits prior to surveying for Clapper Rails. These permits include: USFWS Endangered Species Permit, ESA Section 10(a)(1)(A); California DFG permit (i.e., Memorandum of Understanding); and site-specific permissions (e.g., Special Use Permit from a National Wildlife Refuge).

Personnel and training

Observers must be trained to identify common calls of focal and non-focal marsh bird species in the San Francisco Estuary (see Rail Training document, April 2004). Observers must also be trained to minimize disturbance while conducting surveys (see Walking in the Marsh document, April 2004). Regularly listening to the recorded calls used for surveys can help you learn calls, but surveyors should also practice call identification at marshes (outside the intended survey area if necessary) where the focal species are frequently heard calling.

Annual 1-day training sessions are provided by the Invasive Spartina Project and Point Reyes Bird Observatory before the start of the CLRA survey season (usually in early January). Annual week-long training workshops for the North American Marsh Bird Monitoring Protocol are usually held in March in Yuma, Arizona (contact Courtney Conway, cconway@usgs.gov, for information on upcoming workshops). All surveyors should also be trained to accurately determine distance to calling marsh birds, and to identify the common species of wetland plants within the survey area. Methods for training surveyors to accurately estimate distance include: (1) place broadcast equipment in the marsh at known distance(s) and have surveyors estimate distance; (2) choose a patch of vegetation in the marsh where the bird is thought to be calling from and use a rangefinder to determine distance; (3) have a surveyor estimate the distance to a bird that is calling with regularity and is near a road or marsh edge, then have a second surveyor walk along the road/edge until they are adjacent to that calling bird, and then measure this distance (by pacing or use of a GPS) and see how accurate the surveyor was at estimating distance. Multiple-observer surveys (see below) are very useful here - after the survey is complete have the two surveyors discuss what they heard and their distance estimates to each bird. Periodic multiple-observer surveys not only produce estimates of detection probability but also allow surveyors to determine whether one person is constantly underestimating or overestimating distance to calling birds. First-time surveyors can join surveys conducted by more experienced surveyors in their region prior to starting their own surveys. They should do at least one "trial run" before their first data collection window begins because it takes time to get used to the data sheet and recording the data appropriately.

Supplies needed for surveys

- binoculars
- surveyor flagging (to mark survey points)
- GPS receiver (if needed for navigation)
- clipboard, datasheets, pencils
- aerial photo map with concentric circles marking 50m, 100, 200m
- CD or MP3 file (obtained from the program coordinator - see contact info below)
- CD or MP3 player
- amplified speakers
- sound-level meter with ±5 dB precision
- anemometer
- rangefinder

• batteries for CD/MP3 player, amplified speakers, sound-level meter, anemometer and rangefinder
• thermometer
• compass
• watch to record start and end time
• water

Batteries should be changed or re-charged frequently (before sound quality declines). Surveyors should routinely ask themselves if the quality of the broadcast sound is high. Request a new CD if quality declines. Surveyors should always carry replacement batteries on all surveys. A spare CD player should be kept close-by in case the primary unit fails to operate.

Recommended equipment list

Amplified speakers:

Radioshack "clamshell" amplified speakers (used by FWS, ISP, PRBO; out of stock):
http://gottaget1.blogspot.com/2007/10/inexpensive-compact-folding-speaker.html

Foxpro Spitfire Digital High Performance Game Call ($199):
http://www.amazon.com/Foxpro-Spitfire-Digital-High-Performance/dp/B002YBJXB0/ref=sr_1_1?ie=UTF8&qid=1326066578&sr=8-1

Anemometers:

Ambient Weather HP816A Handheld Wind Meter with Temperature ($25.99):
http://www.amazon.com/Ambient-Weather-HP816A-Handheld-Temperature/dp/B003NG9QCG/ref=cm_cr_pr_product_top

Kestrel 1000 Pocket Wind Meter (used by ISP, $74):
http://www.amazon.com/Kestrel-1000-Pocket-Wind-Meter/dp/B001JEPJZC/ref=sr_1_cc_1?s=hi&ie=UTF8&qid=1326073368&sr=1-1-catcorr

LaCrosse Technology EA-3010U Handheld Anemometer (used by PRBO; ISP had bad experience with these units; $36.99):
http://www.amazon.com/Crosse-Technology-EA-3010U-Handheld-Anemometer/dp/B0002WZRKE/ref=sr_1_cc_1?s=sporting-goods&ie=UTF8&qid=1326075772&sr=1-1-catcorr

Binoculars:

Eagle Optics Ranger 8x42 Roof Prism Binoculars RGR-4208 ($299):
http://www.amazon.com/Eagle-Optics-Ranger-Binoculars-RGR-4208/dp/B004I8Z33E/ref=sr_1_1?s=sporting-goods&ie=UTF8&qid=1326075147&sr=1-1

Nikon 7294 Monarch ATB 8x42 Binocular ($289):
http://www.amazon.com/Nikon-7294-Monarch-8x42-Binocular/dp/B0033PRQB0/ref=sr_1_2?s=sporting-goods&ie=UTF8&qid=1326075227&sr=1-2

Compasses:

Brunton 15TDCL Compass (used by ISP; IMPORTANT feature - can set declination of compass; $30.53):
http://www.amazon.com/Brunton-F-15TDCL-15TDCL-

Compass/dp/B000093ILE/ref=sr_1_1?s=sporting-goods&ie=UTF8&qid=1326075033&sr=1-1

MP3 players:

Many surveyors use personal MP3 players or iPhones.

SanDisk Sansa m230 512 MB MP3 Player ($27.95):
http://www.amazon.com/SanDisk-Sansa-m230-Player-Blue/dp/B000BONJXU/ref=sr_1_20?s=electronics&ie=UTF8&qid=1326073909&sr=1-20

Rangefinders:

Nikon ProStaff 550 Laser Rangefinder ($161.99):
http://www.amazon.com/Nikon-ProStaff-Laser-Rangefinder-Green/dp/B0014SI62Q/ref=sr_1_1?ie=UTF8&qid=1326067961&sr=8-1

Sound level meters:

Extech 407730 Sound Level Meter (used by ISP; $89.99):
http://www.amazon.com/Extech-407730--130-Decibel-Digital-Sound/dp/B000EWY67W/ref=sr_1_1?s=hi&ie=UTF8&qid=1326073521&sr=1-1

CEM Mini Digital Sound Level Meter (used by PRBO; $26.58):
http://www.amazon.com/Mini-Digital-Sound-Level-Meter/dp/B001THX3M0/ref=pd_cp_e_1

Pyle PSPL01 Mini Digital Sound Level Meter (used by FWS; $33.62):
http://www.amazon.com/Pyle-PSPL01-Digital-Sound-Level/dp/B0046IULHO/ref=sr_1_7?ie=UTF8&qid=1326067375&sr=8-7

Data entry

Surveyors are urged to enter their data into the Access database as soon as possible after the surveys are conducted. The database was created to accommodate procedures of this protocol and it was designed to facilitate data management. The database enables efficient entry and storage of marsh bird survey data and ensures that data entered are done so in a consistent way that minimizes data entry errors. In addition to entering your marsh bird survey data, you can also export data.

Organizational information

If you have any feedback on the San Francisco Estuary Marsh Bird Monitoring Protocol, please contact Orien Richmond below:

Dr. Orien Richmond
Don Edwards San Francisco Bay National Wildlife Refuge Complex
1 Marshlands Road
Fremont, CA 94555
Phone: 510-792-0222 x144
Cell: 916-531-6547
Email: orien_richmond@fws.gov

Visit the following website for additional information on the Standardized North American Marsh Bird Protocol, obtaining data sheets, obtaining CDs, and marsh bird monitoring in general:

http://www.cals.arizona.edu/research/azfwru/NationalMarshBird/

If you wish to receive information about the Standardized North American Marsh Bird Protocol and trainings, contact Courtney Conway below:

Dr. Courtney J. Conway
Idaho Cooperative Fish & Wildlife Research Unit
College of Natural Resources
P O Box 441141
Moscow, ID 83844-1141
Phone: (208) 885-6336
Email: cconway@usgs.gov

Acknowledgements

The San Francisco Estuary adaptation of the North American protocol was reviewed by Arriana Brand, Christina Sloop, Issa Woo, Jen McBroom, Julian Wood, Len Liu, Nadav Nur and Orien Richmond. The North American Marsh Bird Monitoring protocol underwent a thorough review by the Marsh Bird User Acceptance Team (Marsh Bird UAT) of the U.S. Fish and Wildlife Service. The members of the UAT (S. Lor, J. Casey, H. Laskowski, T. Doyle, B. Peterjohn, K. Blair, D. Granfors, J. Holler, A. Hanley, M. Wimer, S. Kodrow, and P. Hess) provided substantial comments and suggestions that greatly improved the protocol.

Literature Cited

Alldredge, M. W., Pollock, K. H., Simons, T. R., Collazo, J. A. and Shriner, S. A. 2007. Time-of-detection method for estimating abundance from point-count surveys. The Auk 124(2):653–664.

Conway, C. J. 2011. Standardized North American Marsh Bird Monitoring Protocol. Waterbirds, 34(3):319–3 46.

Riddle, J. D., Pollock, K. H. and Simons, T. R. 2010. An Unreconciled Double-Observer Method for Estimating Detection Probability and Abundance. The Auk, 127(4):841-849.

Thomas, L., Buckland, S. T., Rexstad, E. A., Laake, J. L., Strindberg, S., Hedley, S. L., Bishop, J. R., Marques, T. A. and Burnham, K. P. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology, 47: 5–14. doi: 10.1111/j.1365-2664.2009.01737.x

Marsh bird call types.

Species	Standardized Call Name(s)	Call Code	Sibley Name(s)	BNA Name(s)	Possible Function	Sample on BNA Website
Any	Sighting (visual)	V	-	-	-	-
AMBI	pump-er-lunk	pl	bloonk-adoonk	pump-er lunk and dunk-a-doo	mate attraction, territorial signal	
AMBI	chu-peep	cp	chu-peep	chu-peep	during copulation ceremony	
AMBI	kok	ko	kok-kok-kok	kok-kok-kok or haink	when flushed	
AMCO	burr-up	bu		puhk-cowah; cooah	perturbation (puhk-cowah male, cooah female)	y
AMCO	hic-up	hu	priKI	pow-ur	perturbation (pow-ur male)	y
AMCO	honk	hk				
BLRA	ki-ki-do	kkd	keekeedrr, deedeedunk	kickee-doo or kic-kic-kerr or ki-ki-do	mate attraction, territorial signal	y
BLRA	grr	gr	krr-krr-krr, growling	Growl, grr-grr-grr, brrrr or churr-churrchurr	alarm call, territorial defense	y
BLRA	churt	cht		churt; curt; yip, bip or kik; yelp; kek, ki	alarm call	
BLRA	tch	tch	ink-ink-ink	kik-kik-kik or kuk-kuk-kuk-kuk; ink-ink-ink	when on the nest?	
CLRA	clatter	C	clapper	Clapper or Clatter; chock-chock; caccac-cac or jupe-jupe-jupe	mate communication	y
CLRA	kek	K	ket	kek-kek-kek, kik-kik-kik, bup-bup-bup	mate attraction	y
CLRA	kek-burr	B	ket-ket-karr	kek-burr		y
CLRA	kek-hurrah	KH	grunting	kek-hurrah		y
CLRA	hoo	H		Hoo; oom-oom-oom		
CLRA	squawk	SK	Screech or Shriek; Chase	Squeal or kak	alarm call, territorial disputes	

Species	Standardized Call Name(s)	Call Code	Sibley Name(s)	BNA Name(s)	Possible Function	Sample on BNA Website
CLRA	purr	P		purr; agitated purrrr; churr		
COMO	wipe-out	wo	pep-pep-pehr-peehr	cackle-ka-ka-ka-ka-ka-kee-kree-kreekree		y
COMO	giddy-up	gu				
LEBI	coo	coo	poopoopoo	coo or cooing; tut-tut-tut	mate attraction	y
LEBI	kak	kak	rick-rick-rick	gack-gack	mate communication, alarm call	y
LEBI	ert	ert	kuk	tut-tut-tut; quoh, hah or cackle	alarm call	y
LEBI	ank-ank	aa		ank-ank	when flushed	
PBGR	owhoop	ow	ge ge gadum gadum gwaaaaow	series of wut, whut or kuk notes followed by 4-20 kaow or cow notes	courtship, communication btwn pair, territorial	y
PBGR	hyena	hy	chatter	ek-ek-ek, hn-hn-hn	greeting call	y
SORA	whinny	wh	whinny	decending whinny	territorial defense, mate communication	y
SORA	per-weep	pw	kooEE	per-weep; ker-wee; ter-ee	mate attraction	y
SORA	keep	kee	keek	kee or weep	alarm call	y
VIRA	grunt	g	grunt	grunt	mate communication	y
VIRA	tick-it	t	gik gik gik gik gidik gidik gidik gidik	tick-it	mate attraction	y
VIRA	kicker	ki	chi chi chi chi treerrr	kicker	solicitation	y
VIRA	squawk	sqk	skew; kweek	kiu	alarm call, territorial dispute	y
VIRA	kikik	kk	kikik	ik-ik,	pit-ti-ti-tip	y
YERA	click-click	cc	clicking, tic-tic tictictic	click-click, click-click, click	mate attraction	y
YERA	cackle	ca	cackle	cackle		
YERA	wheeze	whz	wheezing, clucking	wheezes	hostility	

APPENDIX 3: 2012 Survey Station Coordinates

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
17k	Airport Channel	AICH08	568643	4177837
17k	Airport Channel	AICH09	568798	4177707
17k	Airport Channel	AICH10	568909	4177545
17k	Airport Channel	AICH11	569081	4177424
17k	Airport Channel	AICH12	569206	4177257
17k	Airport Channel	AICH13	569288	4177066
17k	Airport Channel	AICH14	569367	4176867
17m	Alameda Island - East	ALAM01	567610	4178422
17m	Alameda Island - East	ALAM02	567754	4178553
17m	Alameda Island - East	ALAM04	567255	4178374
17m	Alameda Island - East	ALAM05	567453	4178421
17m	Alameda Island - East	ALAM06	568113	4178873
15a	Alviso Slough	ALSL06	587497	4145061
15a	Alviso Slough	ALSL07	586870	4145021
15a	Alviso Slough	MAL01	586761	4146451
15a	Alviso Slough	MAL02	586668	4146281
15a	Alviso Slough	MAL03	586774	4146070
15a	Alviso Slough	MAL04	586898	4145918
15a	Alviso Slough	MAL05	586904	4145719
15a	Alviso Slough	MAL06	586942	4145527
17c	Arrowhead Marsh	ARHE01	569510	4177535
02d	B2 South Quadrant	OBE05	570128	4154401
02d	B2 South Quadrant	OBE25	569779	4155053
02d	B2 South Quadrant	OBE26	569843	4154667
02d	B2 South Quadrant	OBE27	569990	4154545
02d	B2 South Quadrant	OBES07	570261	4154520
02d	B2 South Quadrant	OBES24	569733	4154871
23b	Beach Drive	BEF02	545740	4203155
23b	Beach Drive	BEF03	545534	4203145
02a	Belmont Slough	BELM01	566369	4156426
02a	Belmont Slough	BELM02	566069	4156168
02a	Belmont Slough	BELM03	565966	4155996
02a	Belmont Slough	BELM04	565882	4155814
02a	Belmont Slough	BELM05	565895	4155614
02a	Belmont Slough	BELM06	565938	4155419
02a	Belmont Slough	BELM07	566028	4155239
02a	Belmont Slough	BELM08	565828	4155213
20i	Bockmann Channel	BOCH03	574020	4169065
23a	Brickyard Cove	BKYD01	546051	4203904
23a	Brickyard Cove	BKYD02	546885	4204380
23a	Brickyard Cove	BKYD03	547017	4204539
23a	Brickyard Cove	BKYD04	547213	4204591
23a	Brickyard Cove	BKYD05	547402	4204584

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
19a	Brisbane Lagoon	BBLA13	553718	4170275
19a	Brisbane Lagoon	BBLA14	553839	4170046
20g	Bunker Marsh	BUNK01	573456	4170331
20g	Bunker Marsh	BUNK02	573507	4170104
20g	Bunker Marsh	BUNK03	573561	4169912
20g	Bunker Marsh	BUNK04	573631	4169725
05a	Calaveras Point	CAPT08	586510	4147007
05a	Calaveras Point	CAPT09	586281	4146933
05a	Calaveras Point	CAPT10	586087	4146893
05a	Calaveras Point	CAPT11	585889	4146857
05a	Calaveras Point	CAPT12	585689	4146818
05a	Calaveras Point	CAPT13	585492	4146774
05a	Calaveras Point	CAPT14	585113	4146631
05a	Calaveras Point	CAPT15	584912	4146639
12f	Candlestick Cove	CAND01	553478	4173366
13f	Cargill Mitigation Marsh	WTS37	576032	4160957
15c	Charleston Slough	CHSL04	580414	4144826
15c	Charleston Slough Mouth	CHSL03	580657	4145153
20d	Citation Marsh	CITA01	573661	4170466
20d	Citation Marsh	CITA02	573555	4170639
20d	Citation Marsh	CITA03	573435	4170800
20d	Citation Marsh	CITA04	573314	4170961
20d	Citation Marsh	CITA05	573318	4171265
20d	Citation Marsh	CITA06	573316	4171466
20d	Citation Marsh	CITA07	573314	4171666
04i	CMC - Lower	LCMC11	540632	4199553
04i	CMC - Lower	LCMC12	540831	4199466
04j	CMC - Mouth	CMCM11	542747	4199713
04j	CMC - Mouth	CMCM12	542958	4199629
04j	CMC - Mouth	CMCM13	543185	4199682
04j	CMC - Mouth	CMCM14	542814	4199523
04j	CMC - Mouth	CMCM15	543007	4199427
04j	CMC - Mouth	CMCM16	543234	4199447
04h	CMC - Upper	UCMC01	539765	4200265
04h	CMC - Upper	UCMC02	539978	4200186
04h	CMC - Upper	UCMC03	540142	4200079
04h	CMC - Upper	UCMC04	540358	4200046
04h	CMC - Upper	UCMC05	540500	4199902

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
20m	Cogswell - Sec A	COGS01	574738	4166041
20m	Cogswell - Sec A	COGS02	574713	4166250
20m	Cogswell - Sec A	COGS03	574862	4166363
20m	Cogswell - Sec A	COGS04	575059	4166368
20m	Cogswell - Sec A	COGS05	575218	4166336
20m	Cogswell - Sec A	COGS06	575158	4166170
20m	Cogswell - Sec A	COGS07	575043	4166004
20n	Cogswell - Sec B	COGS15	575367	4165223
20n	Cogswell - Sec B	COGS16	575572	4165228
20n	Cogswell - Sec B	COGS17	575710	4165373
20n	Cogswell - Sec B	COGS18	575620	4165538
20n	Cogswell - Sec B	COGS19	575531	4165722
20n	Cogswell - Sec B	COGS20	575436	4165912
20n	Cogswell - Sec B	COGS21	575340	4166092
20o	Cogswell - Sec C	COGS08	574984	4165788
20o	Cogswell - Sec C	COGS09	575124	4165612
20o	Cogswell - Sec C	COGS10	575138	4165412
20o	Cogswell - Sec C	COGS11	575105	4165165
20o	Cogswell - Sec C	COGS12	574791	4165248
20o	Cogswell - Sec C	COGS13	574779	4165542
20o	Cogswell - Sec C	COGS14	574781	4165740
04b	College of Marin	CMER03	540053	4200235
18a	Colma Creek	COCR01	553022	4166328
18a	Colma Creek	COCR02	553220	4166367
18a	Colma Creek	COCR03	552909	4166544
18a	Colma Creek	COCR04	552803	4166743
18a	Colma Creek	COCR05	552817	4166943
18a	Colma Creek	COCR06	553465	4166532
16	Cooley Landing	COLA05	576891	4148770
16	Cooley Landing	COLA06	576956	4148944
16	Cooley Landing	COLA07	577129	4149051
16	Cooley Landing	COLA08	577293	4149164
16	Cooley Landing	COLA09	576775	4148568
16	Cooley Landing	COLA10	576825	4148373
16	Cooley Landing	COLA11	576961	4148238
16	Cooley Landing	COLA12	577112	4148090
02b	Corkscrew Slough	CORK01	569367	4153611
02b	Corkscrew Slough	CORK02	569161	4153310
02b	Corkscrew Slough	CORK03	568904	4152988
02b	Corkscrew Slough	CORK04	568894	4152635
02b	Corkscrew Slough	CORK05	568642	4152904
02b	Corkscrew Slough	CORK06	568356	4153005
02b	Corkscrew Slough	CORK07	567719	4152884

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
15a	Coyote Creek South East	COYE5A	588951	4146466
15a	Coyote Creek South East	COYE5C	588689	4146707
15a	Coyote Creek South East	COYE5E	588312	4146686
15a	Coyote Creek South East	COYE6B	590413	4145832
15a	Coyote Creek South East	COYE6C	590265	4145968
15a	Coyote Creek South East	COYE6D	590121	4146110
15a	Coyote Creek South East	COYE6E	589970	4146243
15a	Coyote Creek South East	COYE6F	589817	4146372
04g	Creekside Park	CRPA01	540284	4200157
04g	Creekside Park	CRPA04	540477	4200115
04g	Creekside Park	CRPA05	540583	4199940
04g	Creekside Park	CRPA06	540535	4200305
20c	Dogbone Marsh	DOGB01	572695	4170847
20c	Dogbone Marsh	DOGB02	572510	4170924
17l	Doolittle Pond	DOPO03	568130	4177879
17l	Doolittle Pond	DOPO04	568396	4177885
05b	Dumbarton/Audubon	DUMW02	579307	4150947
05b	Dumbarton/Audubon	DUMW04	579600	4151224
05b	Dumbarton/Audubon	DUMW06	579902	4151484
05b	Dumbarton/Audubon	DUMW08	580144	4151687
05b	Dumbarton/Audubon	DUMW10	580586	4151671
05b	Dumbarton/Audubon	DUMW12	580548	4151955
05b	Dumbarton/Audubon	DUMW14	580932	4152142
13j	Eden Landing - Mt Eden Creek	EDEN01	576480	4163098
13j	Eden Landing - Mt Eden Creek	EDEN02	576489	4162896
13j	Eden Landing - Mt Eden Creek	EDEN03	576430	4162704
13j	Eden Landing - Mt Eden Creek	EDEN04	576379	4162512
13j	Eden Landing - Mt Eden Creek	EDEN05	576179	4162480
13j	Eden Landing - Mt Eden Creek	EDEN06	575980	4162529
13j	Eden Landing - Mt Eden Creek	WTN11	575778	4162563
13l	Eden Landing Reserve - North	ELRN01	577956	4164180
13l	Eden Landing Reserve - North	ELRN02	578072	4164015
13l	Eden Landing Reserve - North	ELRN03	578199	4163845
13l	Eden Landing Reserve - North	ELRN04	578311	4163694
13k	Eden Landing Reserve - South	ELRS01	578202	4163533
13k	Eden Landing Reserve - South	ELRS02	578057	4163383
13k	Eden Landing Reserve - South	ELRS03	577994	4163189
13k	Eden Landing Reserve - South	ELRS04	578001	4162988
17a	Elsie Roemer, Crab Cove	ELRO01	566123	4178720
17a	Elsie Roemer, Crab Cove	ELRO02	566243	4178686
17a	Elsie Roemer, Crab Cove	ELRO03	566367	4178650
17a	Elsie Roemer, Crab Cove	ELRO04	566478	4178616
17a	Elsie Roemer, Crab Cove	ELRO05	566617	4178557
17a	Elsie Roemer, Crab Cove	ELRO06	566752	4178506
17a	Elsie Roemer, Crab Cove	ELRO07	566904	4178458

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
06a	Emeryville Crescent - East	EMCR07	560954	4186746
06a	Emeryville Crescent - East	EMCR14	561702	4187997
06a	Emeryville Crescent - East	EMCR15	561891	4187888
06b	Emeryville Crescent - West	EMCR01	560428	4186926
06b	Emeryville Crescent - West	EMCR02	560250	4186896
06b	Emeryville Crescent - West	EMCR03	560177	4186720
06b	Emeryville Crescent - West	EMCR04	560358	4186670
06b	Emeryville Crescent - West	EMCR05	560565	4186723
06b	Emeryville Crescent - West	EMCR06	560742	4186744
17j	Fan Marsh	FANM01	568582	4177668
17j	Fan Marsh	FANM03	568635	4177820
17j	Fan Marsh	FANM04	568768	4177689
10c	Giant Marsh	PPF01	556238	4205274
10c	Giant Marsh	PPF05	556420	4205053
10c	Giant Marsh	PPF06	556443	4204834
10c	Giant Marsh	PPF07	556234	4204657
02f	Greco Island - North	GRIN11	570647	4153106
02f	Greco Island - North	GRIN12	570811	4152993
02f	Greco Island - North	GRIN13	570976	4152877
02f	Greco Island - North	GRIN14	571140	4152762
02f	Greco Island - North	GRIN15	571306	4152647
02f	Greco Island - North	GRIN16	571471	4152533
02f	Greco Island - North	GRIN17	571635	4152418
02f	Greco Island - North	GRIN18	571800	4152305
02h	Greco Island - South	GRIS01	573018	4150394
02h	Greco Island - South	GRIS02	573016	4150596
02h	Greco Island - South	GRIS03	573015	4150799
02h	Greco Island - South	GRIS04	573014	4150998
02h	Greco Island - South	GRIS05	572969	4151193
02h	Greco Island - South	GRIS06	572825	4151345
23g	Greenwood Beach	STRA02	543742	4194434
15a	Guadalupe Slough	GUSL02	587891	4143002
15a	Guadalupe Slough	GUSL03	587773	4143515
15a	Guadalupe Slough	GUSL04	587365	4143596
15a	Guadalupe Slough	GUSL05	586585	4143375
15a	Guadalupe Slough	GUSL06	585318	4144262
15a	Guadalupe Slough	GUSL07	585019	4144717
15a	Guadalupe Slough	GUSL08	585795	4144766
15a	Guadalupe Slough	GUSL09	585184	4144825
20s	HARD Marsh	HARD01	575252	4164654
20s	HARD Marsh	HARD02	575438	4164560
20s	HARD Marsh	HARD03	575619	4164493
20s	HARD Marsh	HARD04	575816	4164414
20s	HARD Marsh	HARD05	575988	4164619

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
20p	Hayward Landing	HALA01	574524	4166812
20v	Hayward Landing	HALA03	574717	4166878
20v	Hayward Landing	HALA04	574929	4166935
22e	Hoffman Marsh	HOM06	559640	4195672
22e	Hoffman Marsh	HOM07	559818	4195374
22e	Hoffman Marsh	HOM08	560031	4195055
02l	Inner Bair Island Restoration	IBI11	567713	4150454
02l	Inner Bair Island Restoration	IBI12	567460	4150489
02l	Inner Bair Island Restoration	IBI13	567298	4150636
02l	Inner Bair Island Restoration	IBI14	567141	4150789
02l	Inner Bair Island Restoration	IBI15	567004	4150939
02l	Inner Bair Island Restoration	IBI16	566864	4151086
02l	Inner Bair Island Restoration	IBI17	566763	4151267
18d	Inner Harbor	INHA01	553616	4165999
18d	Inner Harbor	INHA02	553551	4166130
20l	Johnson's Landing	JOLA02	575064	4164736
20l	Johnson's Landing	JOLA03	574999	4164923
20l	Johnson's Landing	JOLA04	574909	4165104
02k	Middle Bair East	MBE01	569714	4153286
02k	Middle Bair East	MBE02	569544	4153178
02k	Middle Bair East	MBE03	569366	4153061
02k	Middle Bair East	MBE04	569249	4152883
02k	Middle Bair East	MBE05	569153	4152697
02k	Middle Bair SE	MBSE02	568726	4151546
02k	Middle Bair SE	MBSE04	568800	4151947
02k	Middle Bair SE	MBSE06	568955	4152326
17h	MLK Marsh	MLKR01	569671	4177003
17h	MLK Marsh	MLKR02	569622	4177196
17h	MLK Marsh	MLKR03	569706	4177372
17h	MLK Marsh	MLKR04	569712	4177546
17h	MLK Marsh	MLKR05	569837	4177413
17h	MLK Marsh	MLKR06	569948	4177254
17h	MLK Marsh	MLKR07	570046	4177104
17d	MLK Regional Shoreline	COCH06	569684	4178668
17d	MLK Regional Shoreline	MLKS03	568671	4179429
17d	MLK Regional Shoreline	MLKS04	568863	4179503
17d	MLK Regional Shoreline	MLKS05	569069	4179578
17d	MLK Regional Shoreline	MLKS06	568952	4179302
17d	MLK Regional Shoreline	MLKS07	568995	4179104
17d	MLK Regional Shoreline	MLKS08	569123	4178953
17d	MLK Regional Shoreline	MLKS09	569336	4178901
17d	MLK Regional Shoreline	MLKS10	569456	4178741
17d	MLK Regional Shoreline	MLKS11	569515	4178546
17d	MLK Regional Shoreline	MLKS12	569437	4178333

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
15a	Mountain View Slough	MVSL04	581043	4145153
15a	Mountain View Slough	MVSL05	581422	4145011
05a	Mowry Marsh North	MOSL10	581198	4151329
05a	Mowry Marsh North	MOSL11	581390	4151379
05a	Mowry Marsh North	MOSL12	581587	4151341
05a	Mowry Marsh North	MOSL13	581780	4151279
05a	Mowry Marsh North	MOSL14	581968	4151220
05a	Mowry Marsh North	MOSL15	582158	4151158
05a	Mowry Marsh North	MOSL16	582349	4151098
05a	Mowry Marsh North	MOSL17	582538	4151036
18b	Navigable Slough	NACH01	552819	4166402
18b	Navigable Slough	NACH02	552647	4166294
05c	Newark Slough	NEW02	581705	4154094
05c	Newark Slough	NEW03	581878	4153982
05c	Newark Slough	NEW04	582059	4153878
05c	Newark Slough	NEW05	582040	4153642
05c	Newark Slough	NEW06	582159	4153474
05c	Newark Slough	NEW07	582333	4153544
05c	Newark Slough	NEW09	581635	4154254
20f	North Marsh	NORT01	573097	4171251
20f	North Marsh	NORT02	572949	4171118
20f	North Marsh	NORT03	572920	4170920
20f	North Marsh	NORT04	572877	4170757
20f	North Marsh	NORT05	572997	4170591
20f	North Marsh	NORT06	573168	4170488
20f	North Marsh	NORT08	573588	4170397
13a	OAC - North Bank	ALCK10	577579	4161047
13a	OAC - North Bank	ALCK11	577774	4161008
13a	OAC - North Bank	ALCK12	577954	4160949
13a	OAC - North Bank	ALCK13	578133	4160880
13a	OAC - North Bank	ALCK14	578290	4160821
13a	OAC - North Bank	ALCK15	578491	4160791
13a	OAC - North Bank	ALCK16	578691	4160828
13a	OAC - North Bank	ALCK17	578844	4160932
13a	OAC - North Bank	ALCK18	578983	4161058
13a	OAC - North Bank	ALCK19	579146	4161152
13a	OAC - North Bank	ALCK20	579342	4161159
13a	OAC - North Bank	ALCK21	579538	4161155
13c	OAC - South Bank	OACS01	576227	4160905
13c	OAC - South Bank	OACS02	576429	4160900
13c	OAC - South Bank	OACS03	576629	4160907
13c	OAC - South Bank	OACS04	576829	4160914
13c	OAC - South Bank	OACS05	577029	4160921
13c	OAC - South Bank	OACS06	577225	4160925
13c	OAC - South Bank	OACS07	577426	4160925

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
13g	OAC - Upstream 20 Tide Gates	ALCK28	580114	4161914
13g	OAC - Upstream 20 Tide Gates	ALCK29	580130	4162090
13g	OAC - Upstream 20 Tide Gates	ALCK30	580175	4162276
20r	Oakland Airport	OAKA01	566746	4175486
20r	Oakland Airport	OAKA02	566898	4175357
20r	Oakland Airport	OAKA03	567055	4175234
18c	Old Marina	OLMA11	553389	4165979
07a	Oro Loma - East	ORLW17	574749	4168949
07a	Oro Loma - East	ORLW18	574912	4169047
07a	Oro Loma - East	ORLW19	575313	4169028
07a	Oro Loma - East	ORLW20	575474	4168815
07a	Oro Loma - East	ORLW21	575441	4168567
07b	Oro Loma - West	ORLW01	574936	4168382
07b	Oro Loma - West	ORLW02	575023	4168204
07b	Oro Loma - West	ORLW03	574972	4168062
07b	Oro Loma - West	ORLW04	574771	4168057
07b	Oro Loma - West	ORLW05	574584	4168057
07b	Oro Loma - West	ORLW06	574382	4168054
07b	Oro Loma - West	ORLW07	574308	4168235
07b	Oro Loma - West	ORLW08	574215	4168393
07b	Oro Loma - West	ORLW09	574150	4168521
07b	Oro Loma - West	ORLW10	574098	4168723
07b	Oro Loma - West	ORLW11	574095	4168866
07b	Oro Loma - West	ORLW12	574302	4168857
07b	Oro Loma - West	ORLW13	574495	4168854
07b	Oro Loma - West	ORLW14	574661	4168784
07b	Oro Loma - West	ORLW15	574739	4168633
07b	Oro Loma - West	ORLW16	574840	4168558
20a	Oyster Bay Regional Shoreline	OYBA01	571103	4173797
20a	Oyster Bay Regional Shoreline	OYBA02	571168	4173609
20a	Oyster Bay Regional Shoreline	OYBA03	571238	4173414
19c	Oyster Cove	OYPC01	553898	4168901
19c	Oyster Cove	OYPC02	554036	4168764
24a	Petaluma River - Upper	PDF12	534648	4230802
24a	Petaluma River - Upper	PDF13	533995	4231302
24a	Petaluma River - Upper	PDF14	534340	4231301
09	Pickleweed Park	PIPK01	544265	4202286
09	Pickleweed Park	PIPK02	544239	4202484
09	Pickleweed Park	PIPK03	544183	4202641
12b	Pier 98/Heron's Head	HEHE01	555235	4176946
12b	Pier 98/Heron's Head	HEHE02	555429	4176923
05h	Plummer Creek Mitigation	PLCM01	583615	4152372
05h	Plummer Creek Mitigation	PLCM02	583484	4152202
05h	Plummer Creek Mitigation	PLCM03	583517	4152021

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
02j	Ravenswood Open Space Preserve	RAOS01	577043	4150353
02j	Ravenswood Open Space Preserve	RAOS02	577133	4150003
02j	Ravenswood Open Space Preserve	RAOS03	577278	4149563
02i	Ravenswood Slough	RAV02	575826	4149650
02i	Ravenswood Slough	RAV03	575665	4149768
02i	Ravenswood Slough	RAV04	575468	4149813
02i	Ravenswood Slough	RAV05	575260	4149863
02i	Ravenswood Slough	RAV06	574884	4150110
02i	Ravenswood Slough	RAV09	574950	4149885
02i	Ravenswood Slough	RAV10	574806	4150724
02a	Redwood Shores	RESH01	568179	4155891
02a	Redwood Shores	RESH02	567964	4155983
02a	Redwood Shores	RESH03	567751	4156006
02a	Redwood Shores	RESH04	567545	4156002
02a	Redwood Shores	RESH06	567118	4156026
02a	Redwood Shores	RESH07	566894	4156065
22c	Rheem Creek Area	RCRA02	555696	4203748
22c	Rheem Creek Area	RCRA03	555821	4203918
22c	Rheem Creek Area	RCRA04	555895	4204106
22c	Rheem Creek Area	RCRA05	555917	4204343
22f	Richmond/Albany Shoreline	ALBB01	560626	4193696
22f	Richmond/Albany Shoreline	ALBB02	560725	4194211
22f	Richmond/Albany Shoreline	ALBB03	560503	4194612
22f	Richmond/Albany Shoreline	ALBB04	560384	4194772
18e	Sam Trans Peninsula	INHA03	553570	4166294
18e	Sam Trans Peninsula	STPN04	553717	4166523
18e	Sam Trans Peninsula	STPN05	553757	4166338
18e	Sam Trans Peninsula	STPN06	553825	4166094
18h	San Bruno Creek	SABR05	552773	4165873
18h	San Bruno Creek	SABR06	553025	4165939
18h	San Bruno Creek	SABR07	553233	4165913
18g	San Bruno Marsh	SBMA01	553847	4166947
18g	San Bruno Marsh	SBMA02	554049	4166950
18g	San Bruno Marsh	SBMA03	554248	4166959
18g	San Bruno Marsh	SBMA04	554455	4166960
18g	San Bruno Marsh	SBMA05	554659	4166973
18g	San Bruno Marsh	SBMA06	553599	4166863
19f	San Bruno Point	SBPT03	554659	4167083
17e	San Leandro Creek	SLEA01	569805	4177557
17e	San Leandro Creek	SLEA02	569923	4177386
17e	San Leandro Creek	SLEA03	570046	4177211
17e	San Leandro Creek	SLEA04	570174	4177030
17e	San Leandro Creek	SLEA05	570298	4176856

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
17e	San Leandro Creek	SLEA06	570418	4176690
17e	San Leandro Creek	SLEA07	570529	4176533
20h	San Lorenzo Creek	SLRZ01	573737	4169556
20h	San Lorenzo Creek	SLRZ02	573659	4169471
20h	San Lorenzo Creek	SLRZ03	573943	4169633
20h	San Lorenzo Creek	SLRZ04	574138	4169774
20h	San Lorenzo Creek	SLRZ05	574277	4169889
20h	San Lorenzo Creek	SLRZ07	573896	4169503
20h	San Lorenzo Creek	SLRZ08	573955	4169323
20h	San Lorenzo Creek	SLRZ09	573951	4169136
26b	San Pablo Bay NWR Shoreline	MAIS11	562041	4216826
26b	San Pablo Bay NWR Shoreline	MAIS12	561920	4217008
26b	San Pablo Bay NWR Shoreline	MAIS13	561807	4217214
26b	San Pablo Bay NWR Shoreline	MAIS14	561653	4217439
26b	San Pablo Bay NWR Shoreline	MAIS15	561476	4217615
23d	San Rafael Canal Mouth	SRCM01	544244	4202876
23d	San Rafael Canal Mouth	SRCM02	544370	4202758
19k	Sanchez Marsh	SANC02	556689	4160466
19k	Sanchez Marsh	SANC03	557028	4160398
19k	Sanchez Marsh	SANC05	556844	4160430
23k	Sausalito	SAUS01	544889	4190648
23k	Sausalito	SAUS02	543392	4191908
23k	Sausalito	SAUS03	543218	4192073
19p	Seal Slough	SEAL01	562560	4158484
19p	Seal Slough	SEAL03	562728	4158450
19p	Seal Slough	SEAL04	562857	4158548
19p	Seal Slough	SEAL05	562861	4158725
19p	Seal Slough	SEAL06	562419	4158215
19p	Seal Slough	SEAL07	562432	4158448
19g	Seaplane Harbor	SFO01	554449	4165785
19g	Seaplane Harbor	SFO02	554517	4165593
19h	SFO	SFO04	555438	4163237
19h	SFO	SFO05	555203	4162889
19h	SFO	SFO06	555111	4162711
19h	SFO	SFO07	555019	4162530
15c	Shoreline Regional Park	CHSL01	580426	4145106
19b	Sierra Point	SIPT01	554044	4170219
19b	Sierra Point	SIPT02	553964	4170061
10b	Southern Marsh	SOUT01	555722	4205728
10b	Southern Marsh	SOUT02	556044	4205561
23l	Starkweather Park	STRK01	544935	4200408
23l	Starkweather Park	STRK02	544765	4200300

Site Code	Site Name	Station ID	X Coordinate	Y Coordinate
22d	Stege Marsh	MEEK03	558280	4196127
22d	Stege Marsh	MEEK04	558463	4196076
22d	Stege Marsh	MEEK06	558770	4195989
22d	Stege Marsh	MEEK07	559080	4195902
02b	Steinberger Slough	RESH13	567756	4154757
02b	Steinberger Slough	RESH14	567816	4154983
02b	Steinberger Slough	RESH15	567780	4154559
02b	Steinberger Slough	RESH16	567956	4155133
02b	Steinberger Slough	RESH17	568105	4155282
02b	Steinberger Slough	RESH18	568239	4155444
15c	Stevens Creek	STEV01	582431	4143425
15c	Stevens Creek	STEV02	582421	4143224
15a	Stevens Creek to Long Point	LONG09	582630	4144724
15a	Stevens Creek to Long Point	LONG10	582401	4144385
15a	Stevens Creek to Long Point	LONG11	582369	4144019
23i	Strawberry Cove	STRC01	542827	4193653
23h	Strawberry Point	STIS03	543732	4193747
23h	Strawberry Point	STIS05	544002	4193415
23h	Strawberry Point	STIS06	543908	4193758
23h	Strawberry Point	STIS07	543777	4193937
23h	Strawberry Point	STRA12	543663	4194319
20j	Sulphur Creek	SULF04	575178	4168030
20j	Sulphur Creek	SULF05	575382	4168032
20j	Sulphur Creek	SULF06	575580	4168049
20w	Triangle Marsh - Hayward	TRMA01	574647	4166655
23n	Triangle Marsh - Marin	TRF02	544339	4197235
23n	Triangle Marsh - Marin	TRF03	544579	4197186
02e	West Point Slough - NW	WPSN03	571586	4151985
02g	West Point Slough - SW / E	WPSS09	572707	4150059
02g	West Point Slough - SW / E	WPSS10	572706	4149686
02g	West Point Slough - SW / E	WPSS11	572704	4149455
02g	West Point Slough - SW / E	WPSS12	572561	4149237
13d	Whale's Tail - North	WTN10	575754	4162376
13d	Whale's Tail - North	WTN4	575865	4161341
13d	Whale's Tail - North	WTN5	575886	4161530
13d	Whale's Tail - North	WTN6	575813	4161676
13d	Whale's Tail - North	WTN7	575771	4161849
13d	Whale's Tail - North	WTN8	575767	4162027
13d	Whale's Tail - North	WTN9	575762	4162212
10a	Whittel Marsh	PTPN01	556260	4206711
10a	Whittel Marsh	PTPN02	556460	4206771
10a	Whittel Marsh	PTPN03	556645	4206685
10a	Whittel Marsh	PTPN04	556830	4206771

APPENDIX 4: Database Design

Feature	Fields	Description
	QC	Date when data was checked for quality (QC'd)
Offset - a line feature connecting survey station to bird observed; contains data on every detection.	OBJECTID	Unique ID of object automatically assigned by ESRI
	Shape	Shape type of object automatically defined by ESRI (LINE)
	Shape_Length	Automatically calculates shape length in meters
	PointID	6-character alphanumeric code for station identification
	Round	Round number (1, 2, or 3)
	DateSurv	Date when survey was conducted
	TimeDet	Time when rail was detected
	FieldRef	Code to ID bird in field on field map and datasheet
	Direction	Compass direction to rail
	Distance	Distance to rail (estimated in meters)
	DistConf	Length value (in meters) representing confidence in distance estimate (eg: +/- # meters)
	Species	4 letter AOU code for species of rail detected
	CallCode	Type of call or detection (for all types of rails)
	MinUniq	Minimum in range of unique rail detected at this location (nullify field if bird was previously recorded and counted on same DATE & site)
	MaxUniq	*Assumed* maximum in range of unique rail detected at this location (nullify field if bird was previously recorded and counted on same DATE & site); assume that detected rail may have a mate
	MinDet	Minimum in range of unique rail detected at this location (nullify field if bird was previously recorded and counted on same DATE & site); NOTE - this field is identical to MinUniq
	MaxDet	*Actual* maximum in range of unique rail detected at this location (nullify field if bird was previously recorded and counted on same DATE & site); do not make assumptions about pairs
	NonSite	Select "Yes" if rail was detected outside of survey site (in SiteDet column enter site in which rail was detected)
	NonSurv	Select "Yes" if rail was detected outside of survey time or between stations
	SiteDet	ISP Monitoring Program subsite code (4-letter subsite code) where rail was detected
	SiteCode	ISP Control Program alphanumeric subsite code (ISP site number + ISP subsite letter) where rail was detected
	Observer	Primary observer conducting survey
	Notes	Enter any relevant information regarding this specific offset
	QC	Date when data was checked for quality (QC'd)
	UniqueID	Unique ID of individual rail detected (PRIMARY KEY)
	ConwayMin	Minute in which rail was detected during 10 minute survey period
	ObsX	X-coordinate of observer if different than location of PointID (ie if observer was between survey stations when rail was detected)
	ObsY	Y-coordinate of observer if different than location of PointID (ie if observer was between survey stations when rail was detected)
	Repeat	Select "Yes" if rail was already counted from a different survey station on the same date and round

Feature	Fields	Description
Location - a point feature at approximate location of observed rail; contains data on each unique detection.	OBJECTID	Unique ID of object automatically assigned by ESRI
	Shape	Shape type of object automatically defined by ESRI (POINT)
	SiteCode	ISP Control Program alphanumeric subsite code (ISP site number + ISP subsite letter)
	Species	4 letter AOU code for species of rail detected
	FieldRef	Code to ID bird in field on field map
	DateSurv	Date when survey was conducted
	Observer	Primary observer conducting survey
	Round	Round number (1, 2, or 3)
	QC	Date when data was checked for quality (QC'd)
	Notes	Enter any relevant information regarding this location
	UniqueID	Unique ID of individual rail detected (PRIMARY KEY)

Feature	Fields	Description
Visit - a point feature defining survey station (location of observer); contains data regarding visit to each survey station, including weather data (which was previously recorded by round in a separate table).	OBJECTID	Unique ID of object automatically assigned by ESRI
	Shape	Shape type of object automatically defined by ESRI (POINT)
	SiteName	Full name of site (eg: Elsie Roemer)
	ISPCode	ISP control program alphanumeric site code (eg: 17a)
	ISPPoint	6-character alphanumeric code for station identification
	SurvDate	Date when survey was conducted
	Start	Starting time of station visit
	SurvType	Type of survey being conducted
	Tape	Enter "Yes" if tape will be played at this station on this round
	Round	Round number (1, 2, or 3)
	Observer	Primary observer conducting survey
	Detections	Enter "Yes" if rails were detected during the station visit
	Temp	Temperature (in Fahrenheit)
	Wind	Wind speed (in mph)
	WindDir	Wind direction (eg: 'wind is blowing from **NE**')
	Cloud	Cloud cover at beginning of survey (expressed as percent of cloud covering sky)
	Sky	Brief description of sky using a coded domain based on the national prorocol (0-clear or a few clouds, 1-partly cloudy or variable sky, 2-cloudy or overcast, 4-fog or smoke, 5-drizzle, 6-rain, or 8-showers)
	Noise	Measurement of the noise at the survey station in decibles (dbC)
	NoiseEst	Estimate of the noise at the survey station using a coded domain based on the national protocol (0-none, 1-faint, 2-moderate, 3-loud, or 4-intense)
	AvianPred	Enter "Yes" if any avian predators/raptors were observed from the survey station, including predators of nests and young
	MamPred	Enter "Yes" if any mammalian predators/signs were observed from the survey station, including predators of nests and young
	PredNotes	Note the type of predator observed
	Notes	Enter any relevant information regarding this specific detection
	X_Coord	X-Coordinate of point in UTMs (Nad 83 Zone 10)
	Y_Coord	Y-Coordinate of point in UTMs (Nad 83 Zone 10)
	QC	Date when data was checked for quality (QC'd)
	Multiple	Enter "Yes" if there was more than one observer recording data at the survey station

Feature	Fields	Description
Site Description - a polygon defining site boundary; contains site descriptions, including observations on pollution and land use.	OBJECTID	Unique ID of object automatically assigned by ESRI
	Shape	Shape type of object automatically defined by ESRI (POLYGON)
	ISPName	Full name of site (ex: Elsie Roemer)
	ISPCode	ISP control program alphanumeric site code (ex: 17a)
	ISPSite	CLRA program 4-letter site ID (ex: ELRO)
	Region	CLRA program region name
	SiteHA	Site area in hectares
	SurvHA	Site area surveyed in hectares, assuming a 200 meter listening threshold around each survey station
	Observer	Primary observer conducting survey
	SurvDate	Date when survey was conducted
	SiteQual	Site Quality: overall quality of habitat for CLRA breeding and foraging
	Disturb	Disturbances to wetland, including construction, restoration, fire, etc.
	Pollut	Pollution at site, including point source, run-off, trash, etc
	SiteNotes	Notes regarding site
	Type2012	Type of survey being conducted

APPENDIX 5: Clapper Rail Survey Forms

Entered:________________

Clapper Rail Survey Form 2012

Target Site________________________**Adjacent Site(s)**____________________**Round**_____**Date** (mm/dd/yy)__________

Observer(s)____________________**Multiple?**_____**Survey Type**__________**Time: Start**________________**End**_____________

Station # -- or -- Bird Species	Tape	Time	Dir. (°)	Dist (m)	Range (m)	Min 1	Min 2	Min 3	Min 4	Min 5	Min 6	Min 7	Min 8	Min 9	Min 10	Outside time?	Outside site?	Notes	Map Ref	Unique Count
																		Site min / max:		

Site Notes: ____

Other Birds at Site

Birds beyond Site

V visual

Clapper Rail:
D duet
C clatter
K kek
B kek-burr
KH kek-hurah
H hoo
SK squawk
P purr

Yellow Rail:
cc click-click
ca cackle
whz wheeze

Black Rail:
kkk kic-kic-kerr
gr grrr
cht churt
tch tch (laugh)

Pied-billed Grebe:
ow owhoop
hy hyena

Cmn Moorhen:
wo wipe-out
gu giddy-up

Virginia Rail:
g grunt
t tick-it
ki kicker
sqk squawk
kk kikik

American Bittern:
pl pump-er-lunk
cp chu-peep
ko kok

Sora:
wh whinny
pw per-weep
kee keep

Least Bittern:
coo coo
kak kak
ert ert

American Coot:
hu hic-up
hk honk

Revised 1/20/2012 JTM

Page___of___

Survey form for call count surveys using Protocol A and C.

F Survey Form **Type 2012:** _____
ISP 2012 **Surv. Rec :** _____

Site: _____ **Sub-site:** _____ **Site Code:** _____

Name: _____ **Date:** _____ **Time:** _____ **Tide:** _____

Nearest CLRA site: _____ **Photo? Yes** __ **No** __ **Width:** _____

Distance: (to nearest CLRA site) **< 200m 201m-500m 501m-800m 800m-1,000m >1,000m**

Marsh Type: Strp __ MF __ CHL __ Pt Bnd __ Mt Bnd __ Open __ Lagn __ CM __

Amount Levee: _____**%** **Levee Vegetation Cover:** _____ **Hard Levee edge? Y N**

Channels:
0. Invaded marsh or shoreline.
1. Only 1st Order
2. 2nd & 3rd Order
3. ≥ 4th Order

Channel Cover:
0. Negligible Veg OR Bank Slump (w/in 1 m)
1. Low Veg OR Bank Slump (w/in 1 m)
2. Mod Veg OR Bank Slump (w/in 1 m)
3. High Veg AND Bank Slump (w/in 1 m)

Spartina Impact:
0. Insignificant impact from *Spartina* invasion/removal
1. Low impact from *Spartina* invasion/removal
2. Moderate impact from *Spartina* invasion/removal
3. High impact from *Spartina* invasion/removal

Treatment Efficacy (annual):
0. No efficacy
1. Low efficacy
2. Moderate efficacy
3. High efficacy

Habitat w/No *Spartina*:
0. Little or no habitat after *Spartina* removal
1. Some low quality habitat remains
2. Lots of low or mod. quality habitat remains
3. Some high quality habitat remains.

Amount Veg: _____ **%**
Dominant veg: _____ _____ **%**
Subdom. Veg: _____ _____ **%**
Other Veg: _____ _____ **%**
_____ _____ **%**

Cover (Hybrid) Spartina _____ **%**

Horizontal Structure: (bird's eye view)
0. Insig.veg.variety (V) & interspersion (I)
1. Low veg.V & I (full veg./ low sp.div.)
2. Mod. V & I (full veg./sp ≥ 4-5)
3. High V & I (full veg./high sp.div.)

Vertical Structure:
0. Most marsh lacks dense canopy
1. < ½ marsh has dense canopy AND ceiling < 10-20 cm
2. < ½ marsh has dense canopy OR ceiling < 10-20 cm
3. > ½ marsh has dense canopy with ceiling ≥ 10-20 cm

Other Birds:
_____
_____
_____

1

Datasheet for habitat evaluation using Protocol F (page 1 of 2).

Site Quality:
0. Poor habitat (little to none)
1. Can support migrant to1-2 breeding pair
2. Can support 3-6 breeding pair
3. Can Support high density CLRA

Hydrology:
___ Fully tidal
___ Slightly muted tidal exposure
___ Extremely muted tidal exposure
___ Poorly drained hydrology

History (marsh age): __ Invaded Shoreline __ Young Restn Site (recently tidal/partial veg)
__ Mature Restn Site __ Old Marsh (natural or restored ≥ 30 YA)

Land Uses (rate 1-3):

1. Airport: Major or minor airport
2. Industry: Industry / commercial property nearby
3. Marina: Marina or docks for boating
4. Rec Area: Recreational Area or park nearby
5. Refuge: Wildlife or conservation area
6. Residential: Residential neighborhood on marsh edge
7. Commercial: Office, shops, hotels, restaurants
8. Road/Fwy: Road/freeway/highway nearby
9. Train: Active train tracks near site
10. Saltpond: Marsh is near a commercial salt pond area
11. Waste Water Trt: Marsh is near a water/sewage treatment area
12. Solid Waste: Landfill, recycling, etc.
13. Other: _____

Raptors: T F _____ **Mammals: T F** _____
_____ _____
_____ _____

Disturbance: _____
_____

Site Notes: _____
_____
_____

Use Likely (Habitat): ___ None ___ Poor ___ Marginal ___ Good ___ (CLRA) Likely Present

Birds:

_____
_____
_____
_____

2

Datasheet for habitat evaluation using Protocol F (page 2 of 2).

San Francisco Estuary Marsh Bird Monitoring Program: Data Sheet (Pilot Study 2012)

Observer__________________ **Target Site Code(s)**________________ **Visit**______ **Date** (e.g., 5-May-2011)________________

Add'l observers____________________ **Site Name(s)**_________________________ **Single or Multiple observer survey (circle 1)**

Map Ref. Letter -OR- Note #	Station ID -OR- Bird Species	Start Time (24-hour)	Bearing (°)	Distance (m)	Distance aid*	Min 1	Min 2	Min 3	Min 4	Min 5	BLRA - Min 6	CLRA - Min 7	SORA - Min 8	VIRA - Min 9	AMBI - Min 10	(Y/N) Outside time?	Outside site?	Counted @ other station?	Wind speed (mph)	Temperature (C)	Sky code**	Noise (dBA/dBC)	Noise code***

Site Notes: ____

V visual

*Distance Aid: **0** none **1** range finder **2** distance bands on aerial photo **3** surveyor flags tied to vegetation
Sky: **0 clear or a few clouds **1** partly cloudy or variable sky **2** cloudy or overcast **4** fog or smoke **5** drizzle **6** rain **8** showers
***Noise: **0** none **1** faint **2** moderate **3** loud **4** intense

Clapper Rail:
C clatter
K kek
B kek-burr
KH kek-hurrah
SK squawk
P purr
CH churr

Black Rail:
kkd ki-ki-doo
gr grrr
cht churt
tch tch (laugh)

Virginia Rail:
G grunt
T tick-it
KI kicker
sqk squawk
kk kikik
kiu kiu

Sora:
WH whinny
PW per-weep
KEE keep

** Cross out any species that were not surveyed due to surveyor being overwhelmed **

American Bittern:
pl pump-er-lunk
cp chu-peep
ko kok

American Coot:
hu hic-up
hk honk
bu burr-up

Common Moorhen:
wo wipe-out
gu giddy-up

Least Bittern:
coo coo
kak kak
ert ert

Yellow Rail:
cc click-click
ca cackle
whz wheeze

Pied-billed Grebe:
ow owhoop
hy hyena

Entered____________ Proofed____________ Page___of___

Survey form for Marsh Bird Monitoring Surveys using the national protocol as part of the pilot study.

APPENDIX 6: 2012 Clapper Rail Survey Results

REGION: Bay Bridge North								
		Round 1		Round 2		Round 3		
Site Name and ID	Survey Type	Date	# CLRA	Date	# CLRA	Date	# CLRA	Notes
Emeryville Crescent - East (06a)	C	1/21/2012 & 2/11/12	0	2/4/2012 & 3/3/12	0	3/10/2012 & 4/2/12	0	
Emeryville Crescent - West (06b)	A	2/11/2012	0	3/3/2012	0	4/2/2012	0	PILOT STUDY: results using standard protocol (Survey Type A)
Emeryville Crescent - West (06b)	N	2/12/2012	0	3/4/2012	0	4/3/2012	0	PILOT STUDY: results using national protocol (Survey Type N)
Whittel Marsh (10a)	A	2/2/2012	0	2/20/2012	0	3/21/2012	**1 - 2**	
Southern Marsh (10b)	A	2/2/2012	0	2/20/2012	0	3/21/2012	0	
Giant Marsh (10c)	C	2/2/2012	0	2/20/2012	**1 - 2**	3/21/2012	0	1 BLRA detected during round 1
Rheem Creek Area (22c)	A	2/14/2012	0	3/10/2012	5 - 8	3/28/2012	**9 - 10**	PILOT STUDY: results using standard protocol (Survey Type A); NOTE: use minimum of range to compare to results from protocol N survey below
Rheem Creek Area (22c)	N	2/16/2012	4	3/11/2012	6	3/29/2012	**10**	PILOT STUDY: results using national protocol (Survey Type N)
Stege Marsh (22d)	A	1/21/2012	0	2/4/2012	**2**	3/10/2012	0	
Meeker Slough (22d)	A	1/21/2012	0	2/4/2012	0	3/10/2012	**1 - 2**	
Hoffman Marsh (22e)	A	1/21/2012	0	2/4/2012	0	3/10/2012	0	
Richmond/Albany Shoreline (22f)	F - C	1/21/2012	0	2/4/2012	0	3/10/2012	0	

REGION: San Leandro Bay								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Elsie Roemer (17a)	A	1/27/2012	0	2/10/2012	0	3/23/2012	0	
Bay Farm Island (17b)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Arrowhead Marsh (17c)	B	1/30/2012	24 - 30	2/15/2012	27	3/28/2012	**32 - 40**	1 SORA and 1 VIRA also detected at site
MLK Regional Shoreline and Airport Channel (17d):								Site split into 5 subsites in 2011
Airport Channel - Fan Marsh Shoreline (17d.1)	A	1/28/2012	0	2/11/2012	0	4/6/2012	0	
Airport Channel - MLK Shoreline (17d.2)	A	1/28/2012	0	2/11/2012	0	4/6/2012	0	
MLK Regional Shoreline - East Creek (17d.3)	A	1/18/2012	0	2/6/2012	0	3/12/2012	0	
MLK Regional Shoreline - Damon Marsh (17d.4)	A	1/18/2012	0	2/6/2012	0	3/12/2012	**1 - 2**	
MLK Regional Shoreline - Elmhurst Creek (17d.5)	A	1/18/2012	0	2/6/2012	0	3/12/2012	0	
San Leandro Creek (17e):								Site split into 2 subsites in 2011
San Leandro Creek - North (17e.1)	A	2/14/2012	0	3/7/2012	0	3/26/2012	0	
San Leandro Creek - South (17e.2)	A	2/14/2012	0	3/7/2012	0	3/26/2012	0	
Oakland Inner Harbor (17f)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Coast Guard Island (17g)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
MLK New Marsh (17h)	A	2/14/2012	**18** [16]	3/7/2012	15 –16 [15]	3/26/2012	17 –18 **[17]**	PILOT STUDY: results using standard protocol (Survey Type A); NOTE: number in bracket excludes rails detected from adjacent transects in order to compare with protocol N results below
MLK New Marsh (17h)	N	2/15/2012	**20**	3/8/2012	19	3/28/2012	8	PILOT STUDY: results using national protocol (Survey Type N); 1 VIRA detected during pilot survey
Coliseum Channels (17i)	F	-	-	-	-	-	-	Insufficient habitat to suport breeding clapper rails
Fan Marsh (17j)	A	1/28/2012	0	2/11/2012	**2**	4/6/2012	1 - 2	
Airport Channel (17k)	A	1/28/2012	0	2/11/2012	0	4/6/2012	0	
Doolittle Pond (17l)	A	1/28/2012	0	2/11/2012	0	4/6/2012	0	
Alameda Island –East(17m)	A	2/3/2012	0	2/21/2012	0	3/12/2012	0	

REGION: Hayward								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Oro Loma - East (07a)	A	1/26/2012	0	2/10/2012	0	3/22/2012	**4**	
Oro Loma - West (07b)	A	1/26/2012	0	2/10/2012	0	3/22/2012	**1 - 2**	
Oyster Bay Reg'l Shoreline (20a)	F - C	1/16/2012	0	2/9/2012	0	3/19/2012	0	
Oakland Golf Links (20b)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Dogbone Marsh (20c)	C	2/16/2012	0	3/9/2012	0	4/3/2012	0	
Citation Marsh (20d)	A	2/16/2012	**6 - 8**	3/9/2012	1 - 2	4/3/2012	3 - 6	PILOT STUDY: results using standard protocol (Survey Type A) NOTE: use minimum of range to compare to results from protocol N survey below
Citation Marsh (20d)	N	2/17/2012	**5**	3/11/2012	**5**	4/4/2012	3	PILOT STUDY: results using national protocol (Survey Type N)
East Marsh (20e)	A	2/16/2012	0	3/9/2012	0	4/3/2012	0	
North Marsh (20f)	A	2/16/2012	0	3/9/2012	5 - 8	4/3/2012	**8 - 10**	
Bunker Marsh (20g)	A	2/16/2012	5 - 6	3/9/2012	**8**	4/4/2012	5 - 8	
San Lorenzo Creek (20h):								Site split into two subsites in 2011
San Lorenzo Creek - North (20h.1)	A	2/16/2012	2	3/9/2012	0	4/4/2012	**2 - 4**	
San Lorenzo Creek - South (20h.2)	A	2/16/2012	0	3/9/2012	0	4/3/2012	0	
Bockmann Channel (20i)	C	2/16/2012	0	3/9/2012	0	4/3/2012	0	
Sulphur Creek (20j)	A	1/26/2012	0	2/10/2012	0	3/22/2012	0	
Hayward Landing (20k)	A	2/3/2012	0	2/22/2012	0	3/8/2012	0	
Johnson's Landing (20l)	A	2/8/2012	0	3/2/2012	0	3/20/2012	0	
Cogswell - Sec A (20m)	A	2/8/2012	0	3/2/2012	0	3/20/2012	0	
Cogswell - Sec B (20n)	A	2/8/2012	**17 –20 [13]**	3/2/2012	4 [2]	3/20/2012	1 – 2 [1]	PILOT STUDY: results using standard protocol (Survey Type A) NOTE: number in bracket excludes rails detected from adjacent transects in order to compare with protocol N results below
Cogswell - Sec B (20n)	N	2/9/2012	**15**	3/3/2012	9	3/22/2012	7	PILOT STUDY: results using national protocol (Survey Type N)
Cogswell - Sec C (20o)	A	2/8/2012	5 - 6	3/2/2012	2 - 4	3/20/2012	**8 - 12**	

REGION: Hayward (continued)								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Hayward Shoreline Outliers (20p)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
San Leandro Shoreline Outliers (20q)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Oakland Airport (20r)	C	2/9/2012	0	3/19/2012	0	4/3/2012	0	
HARD Marsh (20s)	A	2/8/2012	**1 - 2**	3/2/2012	0	3/20/2012	0	
San Leandro Marina (20t)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Estudillo Creek Channel (20u)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Hayward Landing Canal (20v)	C	2/3/2012	0	2/22/2012	0	3/8/2012	0	
Triangle Marsh - Hayward (20w)	A	2/3/2012	0	2/22/2012	0	3/8/2012	0	

REGION: Union City								
		Round 1		Round 2		Round 3		
Site Name and ID	Survey Type	Date	# CLRA	Date	# CLRA	Date	# CLRA	Notes
AFCC - Strip Marsh (01e)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
OAC - North Bank (13a)	A	2/20/2012	0	3/5/2012	0	3/21/2012	0	
OAC - Island (13b)	A	2/20/2012	0	3/5/2012	**3 - 4**	3/21/2012	1 - 2	PILOT STUDY: results using standard protocol (Survey Type A); 5 BLRA detected during standard survey NOTE: use minimum of range to compare to results from protocol N survey below
OAC - Island (13b)	N	2/21/2012	**3**	3/7/2012	2	3/23/2012	1	PILOT STUDY: results using national protocol (Survey Type N); 5 BLRA & 2 VIRA detected during pilot surveys
OAC - South Bank (13c)	A	1/27/2012	0	2/27/2012	0	3/19/2012	0	
Whale's Tail - North (13d)	A	1/27/2012	2 - 4	2/27/2012	**8**	3/19/2012	5 - 6	
OAC - Upstream 20 Tide Gates (13g)	F - C	2/20/2012	0	3/5/2012	0	3/21/2012	0	
Eden Landing - North Creek (13h)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Eden Landing - Pond 10 (13i)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Eden Landing - Mt Eden Creek (13j)	A	1/27/2012	0	2/27/2012	0	3/19/2012	0	
Eden Landing Reserve - South (13k)	C	1/27/2012	0	2/27/2012	0	3/19/2012	0	
Eden Landing Reserve - North (13l)	C	1/27/2012	0	2/27/2012	0	3/19/2012	0	

REGION: Dumbarton Bridge South - Newark, Alviso, and Mountain View								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Cooley Landing (16):								Site split into two subsites in 2011
Cooley Landing-Central(16.1)	A	1/24/2012	0	2/6/2012	0	3/19/2012	**1 - 2**	
Cooley Landing-East (16.2)	A	1/24/2012	0	2/6/2012	0	3/19/2012	0	
Ravenswood Open Space Preserve (02j)	C	1/27/2012	0	2/21/2012	0	3/19/2012	0	
Mowry Marsh North (05a.1)	A	2/1/2012	4 - 8	2/22/2012	**16 - 24**	3/23/2012	4	1 BLRA also detected at site on round 2
Calaveras Point (05a.2)	A	1/29/2012	12	2/16/2012	30 - 34	3/29/2012	**37 - 46**	
Dumbarton/Audubon (05b)	A	2/8/2012	**34- 46 [30]**	3/8/2012	14 - 18 [13]	4/4/2012	8 - 10 [3]	PILOT STUDY: results using standard protocol (Survey Type A) NOTE: number in bracket excludes incidental observations outside of survey time in order to compare with protocol N results below
Dumbarton/Audubon (05b)	N	2/9/2012	**24**	3/9/2012	2	4/5/2012	4	PILOT STUDY: results using national protocol (Survey Type N)
Newark Slough (05c)	A	2/9/2012	**8**	3/2/2012	2 - 4	3/19/2012	3 - 4	PILOT STUDY: results using standard protocol (Survey Type A); NOTE: use minimum of range to compare to results from protocol N survey below
Newark Slough (05c)	N	2/10/2012	**4**	3/4/2012	0	3/20/2012	3	PILOT STUDY: results using national protocol (Survey Type N)
Plummer Crk Mitigation(05h)	A	2/9/2012	0	2/23/2012	0	3/9/2012	0	1 SORA and 4 VIRA detected at site
Charleston Slough (15a.1)	A	1/18/2012	3 - 6	2/22/2012	**5 - 8**	3/10/2012	0	
Mountain View Slough (15a.1)	A	1/18/2012	2 - 4	2/22/2012	**3 - 6**	3/10/2012	0	1 SORA also detected at site during round 1
Stevens to Long Point(15a.2)	C	2/2/2012	0	2/22/2012	0	4/5/2012	0	
Guadalupe Slough (15a.3)	A	2/1/2012	0	2/23/2012	0	3/21/2012	**1 - 2**	5 SORA and 1 VIRA also detected at site
Alviso Slough (15a.4)	A	2/20/2012	0	3/11/2012	0	4/18/2012	**1 - 2**	PILOT STUDY: results using standard protocol (Survey Type A)
Alviso Slough (15a.4)	N	2/21/2012	0	3/12/2012	0	4/19/2012	0	PILOT STUDY: results using national protocol (Survey Type N)
Coyote Creek SE (15a.5)	A	2/1/2012	2 - 4	2/23/2012	**6 - 10**	3/21/2012	2	1 BLRA and 1 VIRA also detected at site
Stevens Creek (15c)	C	2/2/2012	0	2/22/2012	0	4/5/2012	0	1 VIRA also detected at site

REGION: San Mateo								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Belmont Slough (02a):								Site split into three subsites in 2011
Belmont Slough - North (02a.1)	A	2/20/2012	0	3/9/2012	1	4/3/2012	**3 - 4**	PILOT STUDY: results using standard protocol (Survey Type A); NOTE: use minimum of range to compare to results from protocol N survey below
Belmont Slough - South (02a.2)	A	2/20/2012	0	3/9/2012	0	4/3/2012	0	
Redwood Shores / Bird Island (02a.3)	A	1/31/2012	0	2/21/2012	2	3/20/2012	**6 - 10**	
Belmont Slough - North (02a.1)	N	2/21/2012	**5**	3/10/2012	0	4/5/2012	1	PILOT STUDY: results using national protocol (Survey Type N)
Belmont Slough – South (02a.2)	N	2/21/2012	0	3/10/2012	0	4/5/2012	0	
Corkscrew Slough (02b)	A	1/30/2012	**17 - 20**	3/12/2012	2	3/29/2012	1 - 2	
Steinberger Slough (02b)	A	2/3/2012	0	2/21/2012	0	3/12/2012	0	
B2 South Quadrant (02d):								Site split into three subsites in 2011
B2 South Quadrant N (02d.1)	A	1/29/2012	**3 - 4**	2/27/2012	0	3/29/2012	1 - 2	
B2 South Quadrant S (02d.2)	A	1/29/2012	**1 - 2**	2/27/2012	0	3/29/2012	0	
B2 South Quadrant E (02d.3)	A	1/29/2012	0	2/27/2012	0	3/29/2012	0	
West Point Slough-NW (02e)	A	1/18/2012	0	2/8/2012	0	4/6/2012	0	
Greco Island - North (02f)	A	1/29/2012	14 - 18	2/27/2012	**18 - 20**	3/29/2012	6 - 8	Includes rails detected from GRIS stations (comparable to previous years data)
West Point Slough-SW/E (02g)	A	1/18/2012	0	2/8/2012	0	4/6/2012	**1 - 2**	
Greco Island - South (02h)	A	2/20/2012	**22 –30** [24]	3/22/2012	18 - 24 **[25]**	4/5/2012	5 – 6 [8]	PILOT STUDY: results using standard protocol (Survey Type A); NOTE: number in brackets includes all rails detected from Greco South transect regardless of ISP boundaries in order to compare to results from protocol N survey below
Greco Island - South (02h)	N	2/21/2012	**41**	3/23/2012	37	4/6/2012	26	PILOT STUDY: results using national protocol (Survey Type N)

REGION: San Mateo (continued)								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Ravenswood Slough (02i)	A	2/8/2012	1 - 2	3/7/2012	1 - 2	3/21/2012	1 - 2	PILOT STUDY: results using standard protocol (Survey Type A); NOTE: use minimum of range to compare to results from protocol N survey below
Ravenswood Slough (02i)	N	2/10/2012	1	3/8/2012	**2**	3/23/2012	1	PILOT STUDY: results using national protocol (Survey Type N)
Middle Bair N (02k)	A	1/29/2012	15 - 22	2/27/2012	0	3/29/2012	**19 - 20**	
Middle Bair SE (02k)	A	1/29/2012	**2 - 4**	2/27/2012	0	3/29/2012	1 - 2	
Inner Bair Island Restoration (02l)	C	2/2/2012	0	2/22/2012	0	3/21/2012	0	
Pond B3 Bair Island Restoration (02m)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Foster City (19q)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Maple Street Channel (19s)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails

REGION: San Francisco Peninsula								
		Round 1		Round 2		Round 3		
Site Name and ID	Survey Type	Date	# CLRA	Date	# CLRA	Date	# CLRA	Notes
Pier 94 (12a)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Pier 98/Heron's Head (12b)	A	1/25/2012	**1 - 2**	2/8/2012	0	3/27/2012	0	
India Basin (12c)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Hunters Point Naval Reserve (12d)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Yosemite Channel (12e)	F							
Candlestick Cove (12f)	A	1/28/2012	0	2/11/2012	0	3/25/2012	0	
Crissy Field (12g)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Yerba Buena Island (12h)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Mission Creek (12i)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Colma Creek (18a)	A	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Navigable Slough (18b)	A	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Old Marina (18c)	C	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Inner Harbor (18d)	C	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Sam Trans Peninsula (18e)	A	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Confluence Marsh (18f)	A	1/17/2012	0	2/24/2012	0	3/20/2012	0	
San Bruno Marsh (18g)	C	1/17/2012	0	2/24/2012	0	3/20/2012	0	
San Bruno Creek (18h)	C	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Brisbane Lagoon (19a)	F - C	1/28/2012	0	2/11/2012	0	3/25/2012	0	
Sierra Point (19b)	C	1/29/2012	0	2/11/2012	0	3/25/2012	0	
Oyster Cove (19c)	F - C	1/29/2012	0	2/11/2012	0	3/25/2012	0	
Oyster Point Marina (19d)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Oyster Point Park (19e)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
San Bruno Point (19f)	C	1/17/2012	0	2/24/2012	0	3/20/2012	0	
Seaplane Harbor (19g)	C	2/1/2012	0	2/20/2012	0	no survey	-	Only 2 rounds completed at Seaplane Harbor
SFO (19h)	A	2/1/2012	1 - 2	2/20/2012	**3 - 4**	no survey	-	Only 2 rounds completed at SFO
Mills Creek Mouth (19i)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Easton Creek Mouth (19j)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails

REGION: San Francisco Peninsula (continued)								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Sanchez Marsh (19k)	F - C	2/4/2012	0	2/25/2012	0	3/17/2012	0	
Burlingame Lagoon (19l)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Fisherman's Park (19m)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Coyote Point Marina (19n)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
San Mateo Creek (19o)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Seal Slough (19p):								Site split into two subsites in 2011
Seal Slough - Central (19p.1)	A	2/9/2012	0	3/7/2012	0	4/8/2012	0	PILOT STUDY: results using standard protocol (Survey Type A)
Seal Slough - Periphery (19p.2)	A	2/9/2012	0	3/7/2012	0	4/8/2012	0	
Seal Slough - Central (19p.1)	N	2/10/2012	0	3/8/2012	**3**	4/9/2012	0	PILOT STUDY: results using national protocol (Survey Type N)
Seal Slough - Periphery (19p.2)	N	2/10/2012	0	3/8/2012	0	4/9/2012	0	
Anza Lagoon (19r)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails

REGION: Marin								
		Round 1		Round 2		Round 3		
Site Name and ID	Survey Type	Date	# CLRA	Date	# CLRA	Date	# CLRA	Notes
Blackie's Creek (03a)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Blackie's Creek Mouth (03b)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Pickleweed Park (09)	A	1/23/2012	0	2/10/2012	0	3/12/2012	**1 - 2**	
College of Marin (04b)	A	1/24/2012	0	2/20/2012	0	3/12/2012	0	
Larkspur Ferry Landing Area (04e)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Riviera Circle (04f)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Creekside Park (04g)	A	1/24/2012	5 - 8	2/20/2012	4 - 6	3/12/2012	**12 - 14**	
CMC - Upper (04h)	A	1/24/2012	0	2/20/2012	**3 - 4**	3/12/2012	2	
CMC - Lower (04i)	C	1/24/2012	0	2/20/2012	0	3/12/2012	0	
CMC - Mouth (04j)								Site split into two subsites in 2011
CMC Mouth - North Bank (04j.1)	A	1/24/2012	**2 - 4**	2/20/2012	0	3/12/2012	0	
CMC Mouth - South Bank (04j.2)	A	1/24/2012	0	2/20/2012	0	3/12/2012	0	
Murphy Creek (04l)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Brickyard Cove (23a)	F - C	1/23/2012	0	2/6/2012	0	3/26/2012	0	
Beach Drive (23b)	C	1/23/2012	0	2/10/2012	0	3/12/2012	0	
Loch Lomond Marina (23c)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
San Rafael Canal (23d)	A	1/23/2012	0	2/10/2012	0	3/12/2012	**2**	1 BLRA also detected at site
Paradise Cay (23f)	F	-	-	-	-	-	-	Insufficient habitat to support breeding clapper rails
Greenwood Beach (23g)	C	2/3/2012	0	2/21/2012	0	3/12/2012	0	
Strawberry Point (23h)	C	1/19/2012 & 2/3/12	0	2/21/2012 & 3/2/12	0	3/12/2012 & 3/28/12	0	
Strawberry Cove (23i)	C	2/3/2012	0	2/21/2012	0	3/12/2012	0	
Sausalito (23k)	F - C	2/3/2012	0	2/21/2012	0	3/12/2012	0	
Starkweather Park (23l)	C	1/31/2012	0	2/14/2012	0	4/14/2012	0	
Triangle - Marin (23n)	A	1/31/2012	0	2/14/2012	0	4/14/2012	0	

REGION: San Pablo Bay - Vallejo & Petaluma								
		Round 1		Round 2		Round 3		
Site Name and ID	**Survey Type**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Date**	**# CLRA**	**Notes**
Petaluma River - Upper (24a)	A	3/5/2012	0	3/19/2012	0	4/2/2012	**1 - 2**	6 VIRA also detected at site
San Pablo Bay NWR Shoreline (26b)	C	1/30/2012	0	2/16/2012	0	3/26/2012	0	