California Clapper Rail Surveys for the San Francisco Estuary Invasive *Spartina* Project 2010

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Cover photo of California clapper rail courtesy of Walter Kitundu.

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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 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 in 2010. The trained and permitted staff at OEI performed standard-protocol surveys at 116 sites between January 15 and April 15, 2010. 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 2010 season.

Regional population trends between the years 2005 to 2010 are also presented, using a subset of ISP sites for analysis. Annual *Spartina* and clapper rail population data were collected at 30 sites within four regions in the San Francisco Bay. These two data sets are plotted together to demonstrate the change in both populations over time.

2. STUDY AREA

The clapper rail biologists at OEI assessed 116 sites within eleven regions of the San Francisco Estuary for the presence of California clapper rail during the 2010 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 2010. 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. Regional boundaries were identified by the USFWS in 2007 for restoration planning.

To analyze broader-scale trends in California clapper rail abundance, sites were grouped into larger regional boundaries, based on areas designated by USFWS **(Figure 1).** Each region is composed of a varying number of *Spartina* treatment sites and area of tidal marsh habitat. Eleven defined regions are discussed in this report: Bay Bridge North, San Leandro Bay, Hayward, Union City, Newark, Mountain View & Alviso (presented together), San Mateo, San Francisco Peninsula, Marin, Petaluma and Vallejo. Only four of these regions are included in the 2005 to 2010 trend analysis: San Leandro Bay, Hayward, Newark, and San Francisco Peninsula.

Table 1. Summary table of site information, including: type of protocol used, number of survey stations, survey station placement, site area (in hectares), area surveyed (in hectares), and the proportion of marsh surveyed.

Site Name and ID	*Survey Type*	*Survey Stations*	*Station Placement*	*Site Area (ha)*	*Survey Area (ha)* [1]	*Proportion of Site Surveyed*
Bay Bridge North Region						
Emeryville Crescent - East (06a)	A	2	road	21.93	5.89	26.8%
Emeryville Crescent - West (06b)	A	7	road	12.75	12.75	100.0%
Whittel Marsh (10a)	C	4	footpath	25.98	17.37	66.8%
Southern Marsh (10b)	A	2	marsh edge	3.09	3.09	100.0%
Giant Marsh (10c)	A	3	footpath	11.75	11.49	97.8%
Rheem Creek Area (22c)	A	4	footpath	10.54	9.45	89.7%
Richmond/Albany Shoreline (22f)	F - C	4	footpath	5.30	4.37	82.5%

(Table 1 continued on Page 5)

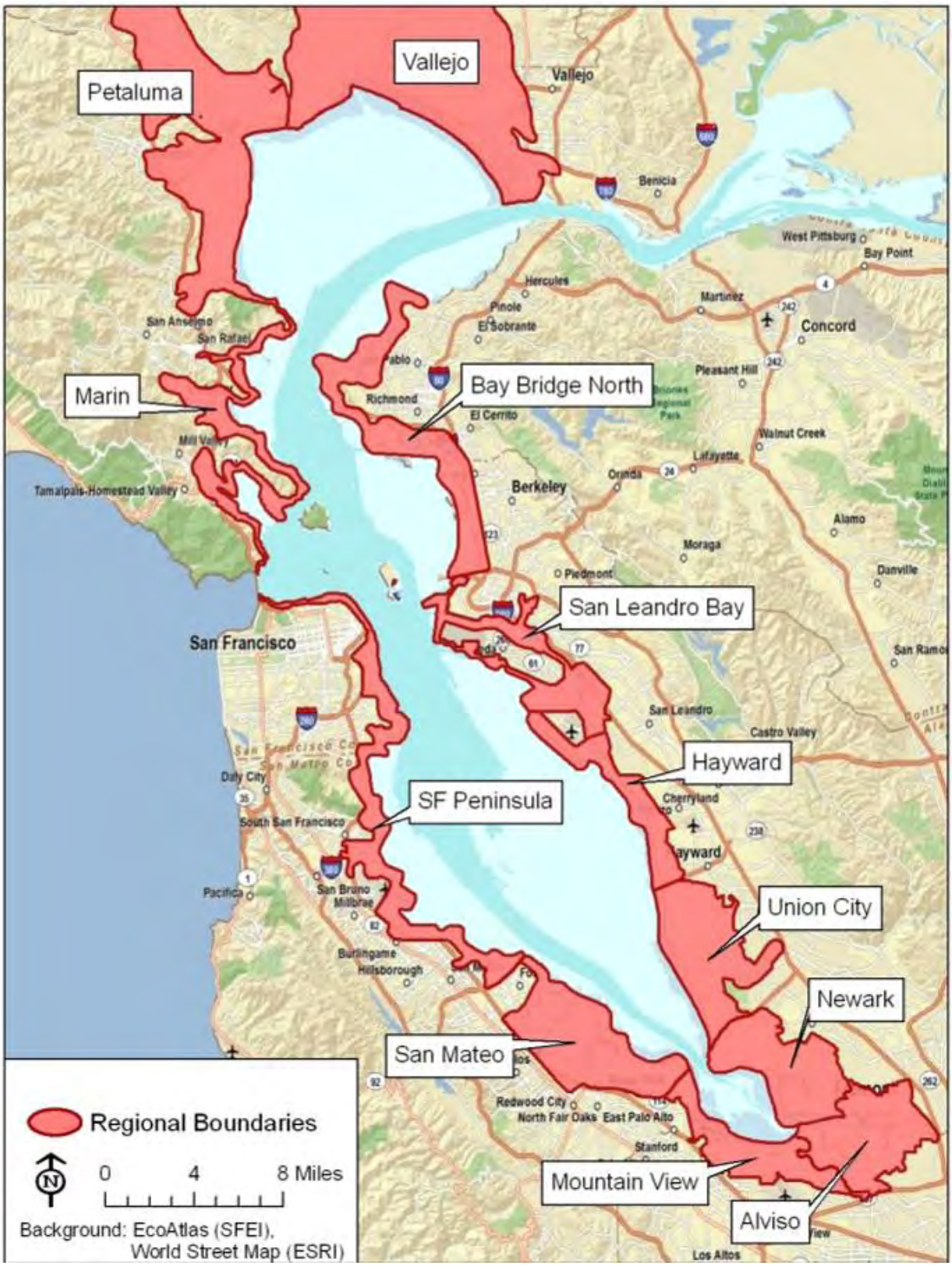

Figure 1. Clapper Rail Regions used by the Invasive *Spartina* Project (based on designations by USFWS)

Table 1. Summary of site information, continued from page 3.

Site Name and ID	Survey Type	Survey Stations	Station Placement	Site Area (ha)	Survey Area (ha) 1	Proportion of Site Surveyed
San Leandro Bay Region						
Elsie Roemer (17a)	A	7	footpath	7.19	7.15	99.4%
Bay Farm Island (17b)	C	7	footpath	3.07	3.07	100.0%
MLK Regional Shoreline (17d)	A	13	footpath	10.96	10.26	93.7%
San Leandro Creek (17e)	A	7	footpath	2.99	2.99	100.0%
Oakland Inner Harbor (17f)	F	0	footpath	1.29	0.70	54.3%
Coast Guard Is (17g)	F	0	footpath	1.26	1.30	100.0%
MLK Marsh (17h)	A	7	footpath	13.89	13.86	99.8%
Coliseum Channels (17i)	F	0	road	5.43	0.39	7.1%
Fan Marsh (17j)	A	3	road & levee	8.63	8.62	100.0%
Airport Channel (17k)	A	7	road	4.68	3.44	73.5%
Doolittle Pond (17l)	A	2	footpath	1.34	1.23	91.7%
Alameda Island - East (17m)	A	5	footpath	1.81	1.68	93.1%
Hayward Region						
Oro Loma - East (07a)	A	8	levee	79.74	51.73	64.9%
Oro Loma - West (07b)	A	16	old levee	52.90	42.97	81.2%
Oyster Bay Regional Shoreline (20a)	A	6	footpath	5.76	5.61	97.5%
Oakland Golf Links (20b)	A	2	footpath	0.78	0.78	100.0%
Dog Bone Marsh (20c)	A	3	footpath	2.85	2.69	94.3%
Citation Marsh (20d)	A	7	levee	45.09	27.65	61.3%
East Marsh (20e)	A	0	footpath	15.04	6.42	42.7%
North Marsh (20f)	A	6	footpath	35.99	33.71	93.7%
Bunker Marsh (20g)	A	4	footpath	14.49	13.71	94.6%
San Lorenzo Creek & Mouth (20h)	A	8	marsh edge	13.58	13.17	97.0%
Bockmann Channel (20i)	F - C	1	footpath	1.01	0.79	77.9%
Sulphur Creek (20j)	A	3	footpath	3.39	3.39	100.0%
Hayward Landing (20k)	C	3	footpath	4.70	3.80	80.8%
Johnson's Landing (20l)	A	3	footpath	4.10	3.80	92.9%
Cogswell - Sec A (20m)	A	7	footpath	14.16	14.12	99.7%
Cogswell - Sec B (20n)	A	7	footpath	40.53	37.28	92.0%
Cogswell - Sec C (20o)	A	7	footpath	20.15	20.11	99.8%
Hayward Shoreline Outliers (20p)	F	0	footpath	1.57	1.57	100.0%
San Leandro Shoreline Outliers (20q)	F	0	footpath	4.68	3.96	84.6%
Oakland Airport (20r)	C	3	road	16.75	5.23	31.3%
HARD Marsh (20s)	A	5	footpath	26.65	21.32	80.0%
San Leandro Marina (20t)	F	0	road	3.93	3.93	100.0%
Estudillo Creek Channel (20u)	F	0	levee	5.81	0.17	2.9%
Hayward Landing Canal (20v)	F	0	footpath	2.28	2.28	100.0%
Triangle Marsh - Hayward (20w)	C	1	footpath	5.00	4.48	89.6%

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

Site Name and ID	Survey Type	Survey Stations	Station Placement	Site Area (ha)	Survey Area (ha) [1]	Proportion of Site Surveyed
Union City Region						
Eden Landing - North Creek (13h)	F	0	levee	14.51	14.51	100.0%
Eden Landing - Pond 10 (13i)	F	0	footpath	87.46	0.08	0.1%
Eden Landing - Mt Eden Creek (13j)	C	6	footpath	50.52	24.96	49.4%
Eden Landing Reserve - South (13k)	F	0	footpath	96.88	96.88	100.0%
Newark Region						
Newark Slough (05c)	A	7	bay trail	93.97	18.46	19.6%
Mountain View & Alviso Regions						
Ravenswood Open Space Preserve (02j)	F - C	3	levee	9.56	8.80	92.0%
Alviso Slough (15a)	A	8	levee	117.52	24.78	21.1%
Charleston Slough (15a & c)	A	5	levee	44.33	20.03	45.2%
Stevens Creek (15a & c)	A	5	levee	23.69	21.04	88.8%
Cooley Landing (16a)	A	8	footpath	71.96	45.69	63.5%
San Mateo Region						
Belmont Slough (02a)	A	8	footpath	53.83	27.13	50.4%
Redwood Shores (02a/b)	A	8	footpath	69.79	32.41	46.4%
B2 South Quadrant (02d)	A	6	levee	76.12	35.51	46.7%
West Point Slough - NW (02e)	C	1	kayak	2.32	1.94	83.7%
Greco Island - North (02f)	A	8	boardwalk	201.73	61.04	30.3%
West Point Slough - SW / E (02g)	C - A	5	road	16.55	5.16	31.1%
Greco Island - South (02h)	A	6	old levee	94.30	37.29	39.5%
Ravenswood Slough/Mouth (02i)	A	7	footpath	47.61	26.76	56.2%
Inner Bair Island Restoration (02l)	A	7	footpath	20.02	16.95	84.7%
Foster City (19q)	F	0	footpath	2.19	2.19	100.0%
SF Peninsula Region						
Pier 98/Heron's Head (12b)	F	0	footpath	4.42	4.42	100.0%
India Basin (12c)	F	0	road & footpath	0.85	0.85	100.0%
Hunters Point Naval Reserve (12d)	F	0	levee	0.51	0.51	100.0%
Yosemite Channel (12e)	F	0	road	1.34	1.34	100.0%
Candlestick Cove (12f)	F	0	road	0.75	0.75	100.0%
Colma Creek (18a)	A	6	footpath	2.81	2.57	91.4%
Navigable Slough (18b)	C	2	footpath	1.25	1.25	100.0%
Old Marina (18c)	A	1	footpath	1.91	1.87	98.3%
Inner Harbor (18d)	A	2	footpath	3.26	3.26	100.0%
Sam Trans Peninsula (18e)	A	4	footpath	5.78	5.34	92.5%
Confluence Marsh (18f)	A	0	footpath	2.92	2.90	99.5%
San Bruno Marsh (18g)	A	6	footpath	11.53	11.10	96.2%
San Bruno Creek (18h)	C	3	footpath	2.06	1.74	84.7%
Brisbane Lagoon (19a)	F - C	4	road	6.41	3.53	55.1%
Sierra Point (19b)	C	2	footpath	0.98	0.98	100.0%

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

Site Name and ID	Survey Type	Survey Stations	Station Placement	Site Area (ha)	Survey Area (ha) [1]	Proportion of Site Surveyed
SF Peninsula Region (cont'd)						
Oyster Cove (19c)	F - C	2	road	1.24	1.24	100.0%
Oyster Point Marina (19d)	F - C	1	road	0.67	0.46	68.3%
Oyster Point Park (19e)	F - C	2	footpath	0.96	0.96	100.0%
Point San Bruno (19f)	F - A	1	footpath	1.83	0.86	47.0%
Seaplane Harbor (19g)	A	2	road	1.67	1.61	96.9%
SFO (19h)	A	6	road	10.18	6.60	64.9%
Mills Creek Mouth (19i)	F - C	1	footpath	1.11	1.11	100.0%
Easton Creek Mouth (19j)	F - C	2	footpath	2.70	2.49	92.2%
Sanchez Marsh (19k)	F - C	3	footpath	6.14	6.05	98.5%
Burlingame Lagoon (19l)	F	0	footpath	3.08	3.08	100.0%
Fisherman's Park (19m)	F	0	footpath	0.54	0.54	100.0%
Coyote Point Marina (19n)	F	0	footpath	5.62	5.62	100.0%
San Mateo Creek (19o)	F	0	footpath	1.22	1.22	100.0%
Seal Slough Mouth (19p)	A	6	marsh edge	27.74	23.04	83.0%
Anza Lagoon (19r)	F	0	footpath	1.77	1.77	100.0%
Marin Region						
Blackie's Creek (03a)	F	0	footpath	0.22	0.22	100.0%
Blackie's Creek Mouth (03b)	F	0	footpath	0.40	0.40	100.0%
College of Marin (04b)	C	1	footpath	1.79	1.00	55.8%
Larkspur Ferry Landing Area (04e)	F	0	road	0.42	0.42	100.0%
Riviera Circle (04f)	F	0	kayak	1.56	1.56	100.0%
CMC - Upper (04h)	A	5	footpath	5.53	5.20	94.0%
CMC - Lower (04i)	A	2	footpath	6.44	2.55	39.6%
Murphy Creek (04l)	F	0	road	1.83	1.83	100.0%
Pickleweed Park (09a)	A	3	footpath	3.88	3.88	100.0%
Brickyard Cove (23a)	F - C	1	footpath	0.35	0.33	92.0%
Beach Drive (23b)	C	1	road	3.52	3.31	94.1%
Loch Lomond Marina (23c)	F	0	road	2.92	0.24	8.3%
San Rafael Canal Mouth North (23d)	A	2	road	2.71	2.71	100.0%
Paradise Cay (23f)	F	0	road	9.09	9.09	100.0%
Greenwood Beach (23g)	C	1	footpath	1.60	1.53	95.7%
Strawberry Point (23h)	C	1	kayak	5.57	1.18	21.2%
Strawberry Cove (23i)	C	1	footpath	4.27	3.32	77.8%
Sausalito (23k)	F	0	footpath	9.17	9.17	100.0%
Starkweather Park (23l)	C	1	road	3.36	3.03	89.9%
Triangle Marsh - Marin (23n)	C	2	road	7.73	5.87	76.0%

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

Site Name and ID	Survey Type	Survey Stations	Station Placement	Site Area (ha)	Survey Area (ha) [1]	Proportion of Site Surveyed
Petaluma Region						
Petaluma River - Upper (24a)	A	4	footpath	73.73	32.17	43.6%
Grey's Field (24b)	A	3	footpath	43.93	12.03	27.4%
Vallejo Region						
San Pablo Bay NWR Shoreline (26b)	C	5	levee	1042.5	19.60	1.9%

[1] Assuming a 200 meter detection threshold around each survey station

3. METHODS

3.1 FIELD METHODS

California clapper rail surveys were conducted between January 15 and April 15, 2010, using standardized survey protocols approved by the USFWS (**Appendix 1**). All surveys were conducted by the trained and permitted avian field biologists at Olofson Environmental Inc: Allison Nelson, Jeanne Hammond, Jeffery Lewis, Jen McBroom, Jude Stalker, Stephanie Chen, Tobias Rohmer and Whitney Thornton.

We surveyed 116 *Spartina* treatment sites for clapper rails or for clapper rail habitat. Call count surveys were conducted at 87 of the 116 sites. The remaining 29 sites were evaluated for the presence of habitat only (F-survey) and were deemed unlikely to be used by breeding clapper rail. The three types of survey protocols employed by OEI biologists in 2010 are summarized below.

Protocol A: Clapper rail breeding season passive call count survey

Protocol A is the standard "walking transect" survey protocol written by USFWS biologists and used by researchers throughout the San Francisco Estuary to document California clapper rail presence during the breeding season and to calculate rail relative abundance and/or density. 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. In large marsh parcels, PRBO surveyors place stations at 400 m intervals, as recommended by Conway in Standardized North American Marsh Bird Monitoring Protocols (2005). The number of survey stations established at each site varies due to site size, configuration, and accessibility. The locations of the survey stations are entered into a GIS and navigated to in the field using a GPS unit. For consistency and repeatability, all efforts are made to use the same survey station locations that were established during the previous survey seasons (see **Appendix 2** for a complete list of survey stations used in 2010).

Sites are visited at least three times during the season, with at least two weeks between visits. Three site complexes (Cogswell A/B/C, Fan Marsh/Doolittle Pond/Airport Channel, and MLK Restoration Marsh) were surveyed five times each. During the first two rounds, a trained observer stands at each point for 10 minutes, recording all rails detected visually or aurally. For each bird or pair of birds detected the observer records: (1) the number of birds, (2) the call type, and (3) distance and angle on a pre-printed datasheet. The timing of each detection was also recorded using the survey start time and the ordinal minute of the detection in that 10-minute survey period (Conway 2005). 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-m

radius of a survey station, pre-recorded clapper rail vocalizations are broadcasted after the first five minutes of passive survey during round three. Broadcasts are played for no longer than one minute to elicit a response from rails. The standardized pre-recorded vocalizations are provided by U.S. Fish and Wildlife Service and are played from a compact disc or mp3 player with portable speakers. If a clapper rail responds during the broadcast call, the speakers and player are immediately turned off.

Protocol C: Clapper rail breeding season active playback surveys

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 walking transect survey (Protocol A), except that it allows permitted biologists to play pre-recorded rail vocalizations during the 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 m of the detection.

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 F: Clapper rail habitat assessment surveys

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. Sites are (re)evaluated in this fashion every year.

3.2 DATA COLLECTION AND MANAGEMENT

We used ArcEditor 9.3.1 (Environmental Systems Research Institute Inc., Redlands, CA) to create a personal geodatabase to store and manage clapper rail survey data in 2010. The design of the geodatabase was based on a preexisting Access database developed by PRBO Conservation Science in 2005. All table and query elements of the Access database were preserved in the geodatabase, along with the spatial components of the data. For instance, weather data (temperature, cloud cover, wind speed, and precipitation) were recorded for each round within the polygon delineating the boundary of the site surveyed (see **Appendix 3** for complete geodatabase design).

Data were recorded in the field on paper datasheets (**Appendix 4**), 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 (**Appendix 3**). Each rail observation was recorded on a paper datasheet with time detected, call type, number of rails, 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. Any other birds observed at the site were recorded at the bottom of the datasheet.

In the office, data were uploaded from the GPS units and checked-in to the master geodatabase. Each observer maintained his/her own data in the geodatabase during the field season by filtering with definition queries. Data entered into ArcPad in the field were added to 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 'offsets' (**Appendix 3**). 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.

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 would be re-evaluated to minimize duplicate counting of rail/pairs when detected by multiple surveyors.

3.3 DATA INTERPRETATION

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 of 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 highest count to determine the final range of rails detected for each site.

Additionally, we calculated the percent occurrence of clapper rails at each site and averaged by region. The percent occurrence was expressed as a percentage of the number of stations where clapper rail were detected out of the total number of stations sampled (visits) during the season

Table 2. Types of Detection

Detection type	Description	Number of Rails	
		Min	Max
C	"Clatter"	1	2
D	Duet - two (or more) simultaneous "clatters"	2	2 +
K	"Kek"	1	2
AK	Agitated "kek"	1	2
kkb	"Kik-kik-burr"	1	2
SK	"Squawk"	1	2
SC	"Screech"	1	2
CH	"Churr"	1	2
P	"Purr"	1	2
V	Visual	1	2

3.4 TREND ANALYSIS

A subset of sites surveyed by ISP in 2010 was used to evaluate trends in both clapper rail and hybrid *Spartina* populations. We only included data from sites with six years of consecutive call count data (using either Protocol A or C) in this analysis. Clapper rail surveys included in the analysis were conducted by four organizations: the Invasive *Spartina* Project, Avocet Research Associates, East Bay Regional Park District, and PRBO Conservation Science. *Spartina* inventory monitoring data were collected by OEI field biologists annually. Ingrid Hogle, the Invasive *Spartina* Project Monitoring Program Manager combined and analyzed the annual data presented here. For the trend analysis, we included clapper rail data from 30 sites invaded by non-native *Spartina* within four regions of the San Francisco Bay: San Leandro Bay, Hayward, Newark, and San Francisco Peninsula.

Spartina data were collected by the Invasive *Spartina* Project Monitoring Program as part of an annual inventory of the estuary for non-native *Spartina* populations. OEI Field

Biologists survey potential habitat for invasive *Spartina* from May to November each year. The location, extent, and percent cover of non-native *Spartina* are mapped using ArcPad and collected into a geodatabase. For the trend analysis presented here, Ingrid Hogle (ISP Monitoring Program Manager) calculated the net area of the non-native *Spartina* (in hectares) within the digitized boundaries of the 30 sites invaded sites. We present *Spartina* data from 2004 to 2009, summarized in December 2010. Additionally, we provide a best estimate of net *Spartina* in hectares for 2010, though these data have not been analyzed in time for this publication.

Spartina data were plotted by year on the primary axis, while the clapper rail detections were plotted by year on the secondary axis. The percent change in both *Spartina* and clapper rail populations were calculated annually and for the entire study period. Percent change was calculated as the value at end of period subtracted by the value at beginning of period, all divided by the value at beginning of period, and expressed as a percentage. Finally, a linear trend was calculated for both *Spartina* and clapper rail populations to demonstrate the change in the populations over the six year study period.