

This is a report to the California Landscape Conservation Cooperative (CALCC) describing the development of the online interactive data summary tool for shorebird monitoring data from the CALCC and other regions in the Pacific Flyway as part of the Pacific Flyway Shorebird Survey (PFSS). Report was compiled and submitted May 2011.

## Contributing Authors



Matthew Reiter - PI  
Leo Salas  
Thomas Fonseca  
Doug Moody  
Catherine Hickey

PRBO Conservation Science, 3820 Cypress Drive #11, Petaluma, CA  
94954

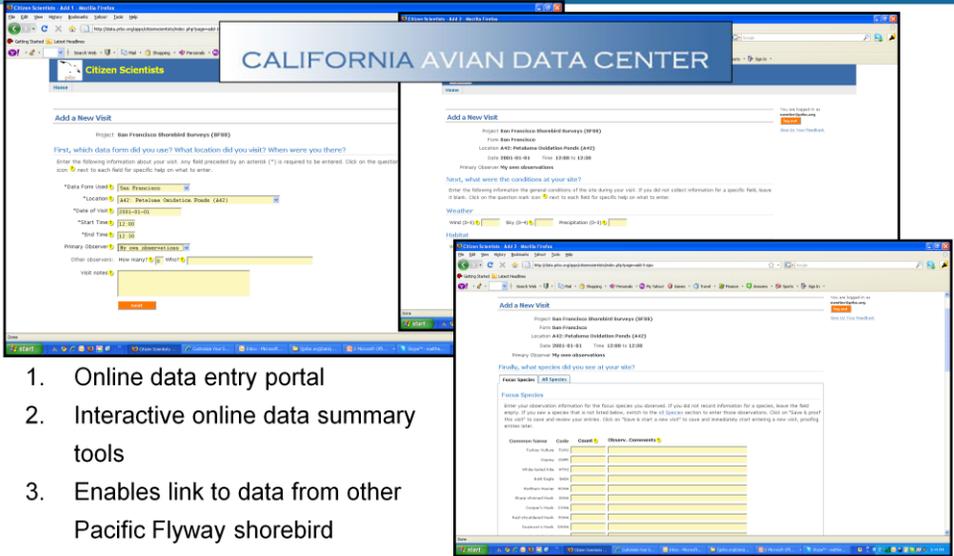
This work was completed through the teamwork of multiple contributing authors at PRBO Conservation Science.

PRBO Conservation Science



# Data Centralization

*"The Glue"*

**CALIFORNIA AVIAN DATA CENTER**

**Citizen Scientists**

**Add a New Visit**

Project: San Francisco Shorebird Surveys (SFSS)  
 First: San Francisco  
 Location: A42: Petaluma-Declaration Road (A42)  
 Date: 2008-01-01 Time: 10:00 to 12:00

Firstly, which data form did you use? What location did you visit? When were you there?  
 Enter the following information about your visit. Any field preceded by an asterisk (\*) is required to be entered. Click on the question mark (?) next to each field for specific help on what to enter.

\*Data Form Used: [San Francisco]  
 \*Location: [A42: Petaluma-Declaration Road (A42)]  
 \*Date of Visit: [2008-01-01]  
 \*Start Time: [10:00]  
 \*End Time: [12:00]

Primary Observer: [My own observation]  
 Other Observers: How many? [0] Who? [ ]

Visit notes: [ ]

**Add a New Visit**

Project: San Francisco Shorebird Surveys (SFSS)  
 First: San Francisco  
 Location: A42: Petaluma-Declaration Road (A42)  
 Date: 2008-01-01 Time: 10:00 to 12:00

Firstly, what species did you see at your site?  
 Enter the following information for the general category of the site during your visit. If you did not collect information for a specific field, leave it blank. Click on the question mark icon (?) next to each field for specific help on what to enter.

Weather: [ ]  
 Wind: [ ]  
 Humidity: [ ]

Next, what were the conditions at your site?  
 Enter the following information for the general category of the site during your visit. If you did not collect information for a specific field, leave it blank. Click on the question mark icon (?) next to each field for specific help on what to enter.

Visit notes: [ ]

**Add a New Visit**

Project: San Francisco Shorebird Surveys (SFSS)  
 First: San Francisco  
 Location: A42: Petaluma-Declaration Road (A42)  
 Date: 2008-01-01 Time: 10:00 to 12:00

Firstly, what species did you see at your site?  
 Enter the following information for the focus species you observed. If you did not record information for a species, leave the field blank. If you used a species that is not listed below, click on the "I don't know" button to enter focus observations. Click on "Save a draft" to save and return your entries. Click on "Save to start a new visit" to save and immediately start entering a new visit, creating another entry.

Focus Species: [all species]

Enter your observation information for the focus species you observed. If you did not record information for a species, leave the field blank. If you used a species that is not listed below, click on the "I don't know" button to enter focus observations. Click on "Save a draft" to save and return your entries. Click on "Save to start a new visit" to save and immediately start entering a new visit, creating another entry.

Common Name	Code	Count	Observ. Comments
Golden Plover	GPLOV		
Western Gull	WGULL		
White-headed Gull	WHGULL		
Red Gull	RDGULL		
Mourning Dove	MDOVE		
Sharp-shinned Hawk	SHSHAWK		
Red-tailed Hawk	RETHAWK		
Sharp-shinned Hawk	SHSHAWK		
Red-tailed Hawk	RETHAWK		

1. Online data entry portal
2. Interactive online data summary tools
3. Enables link to data from other Pacific Flyway shorebird projects

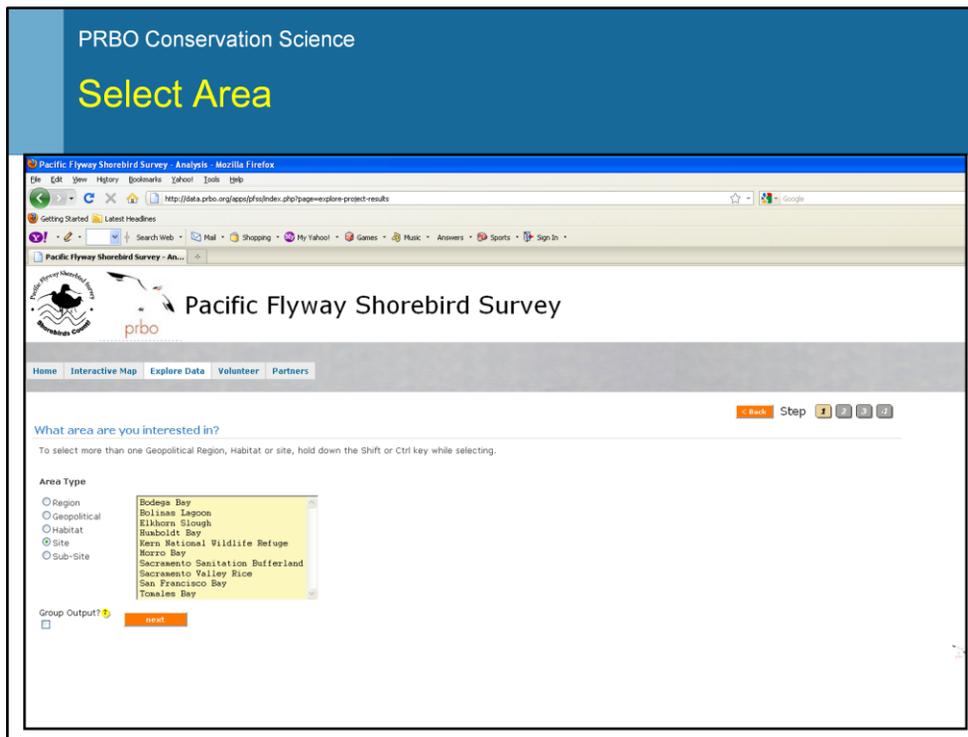
With the support of 2010 CA LCC funding we developed and launched (1) an online data entry portal for wintering shorebird monitoring in the CA LCC as part of the Pacific Flyway Shorebird Survey (report submitted March 2011) and (2) interactive data summary tools to visualize shorebird monitoring data. Data centralization is the essential glue to hold large-scale monitoring programs together over time through data standardization and the interactive data summary application which will provide rapid feedback about the results of the surveys at user-defined spatial scales. Here we summarize the recently completed interactive data summary tool.

## The Interactive Data Summary Tool

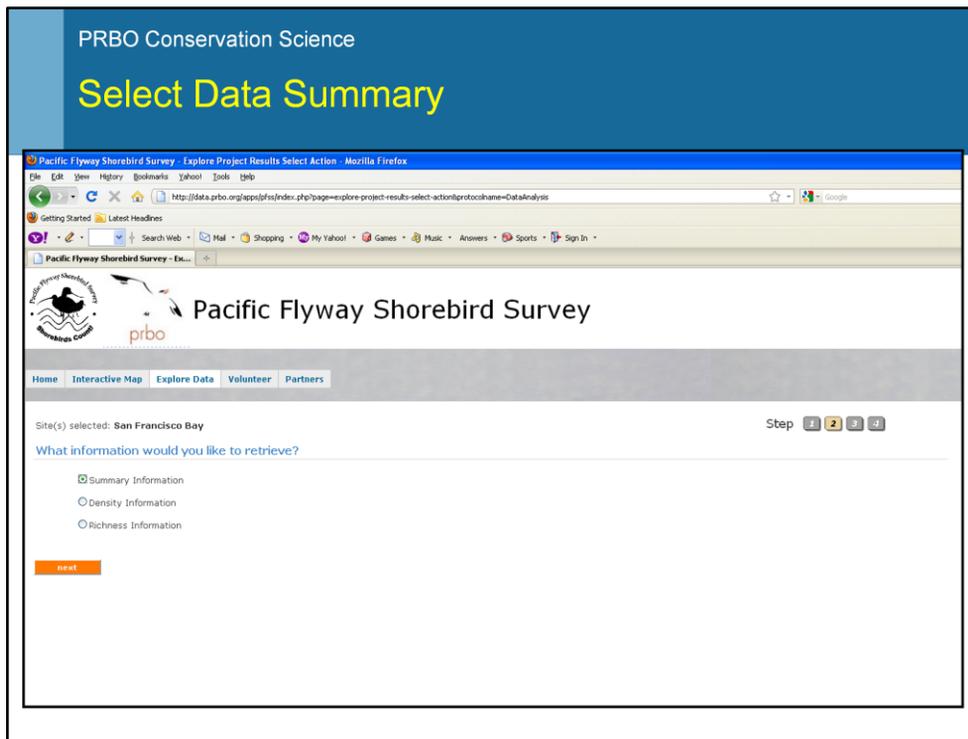
### 3-Step Process

1. Select an area or region for which you want data summaries.
2. Select the type of data summaries you want.
3. Select the year and species (if applicable) for which you want summaries.

Visualizations of shorebird survey data stored in the California Avian Data Center as part of the Pacific Flyway Shorebird Survey are available at several user-defined spatio-temporal scales by completing 3-steps.



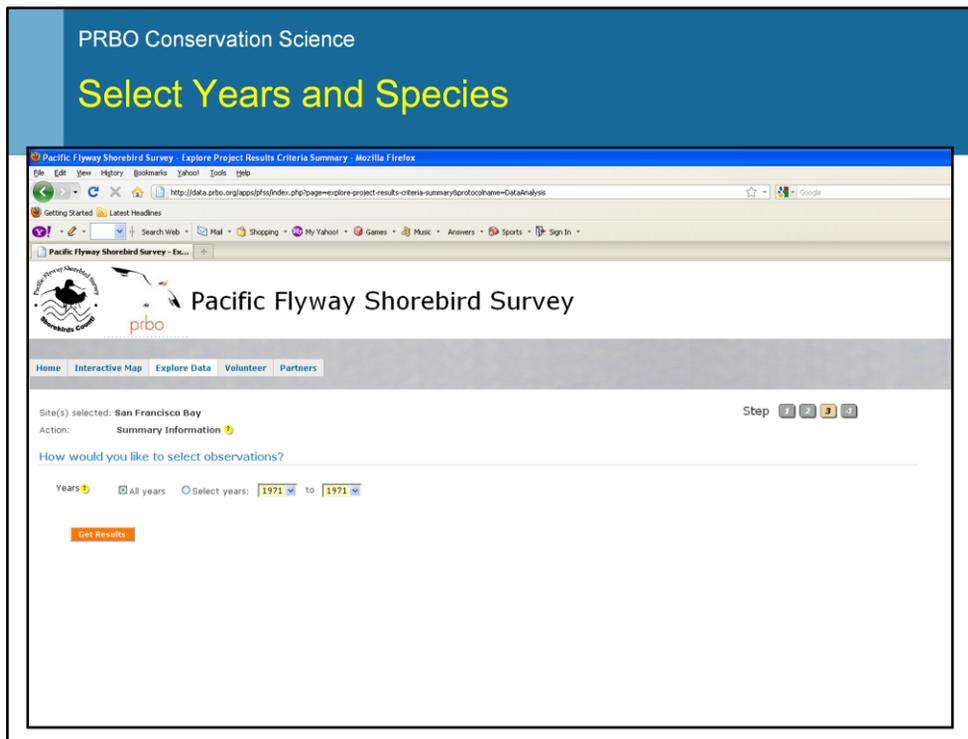
The first step is to select the region or habitat at which data summaries should be evaluated. Current options include: (1) Geopolitical, (2) Region, (3) Habitat, (4) Site, or (5) Sub-site. Data can also be grouped to look at multiple selections simultaneously.



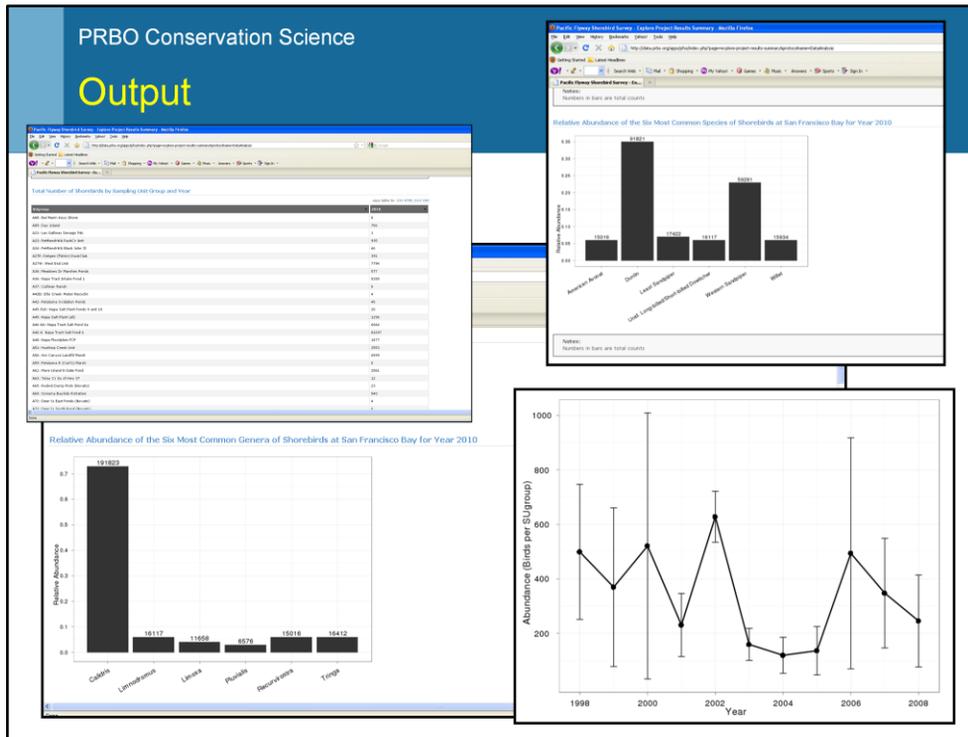
Step 2 is to select the data summary types. Currently, there are three data summary options:

- (1) Summary Information – composition of shorebirds by genus and species as well as the total shorebird abundance and total species observed.
- (2) Density Information – average number of shorebirds by species per sampling unit. If multiple-years of data are available simple trend estimates are generated.
- (3) Richness Information – average number of species observed per sampling unit.

See Appendix 1 for more detail on data summaries.



The last step is to select which years and which species (only for “Density Information”) that you want to summarize.



Outputs are generated in both table and graph formats which can be easily exported.

## Next Steps

- Trend Models
- Habitat Association Models
- Adaptive Management



The infrastructure is now in place to develop additional shorebird data summaries using data as they become available through annual monitoring efforts. Over the next 2 years we will use the framework developed as part of this project to expand this tool's functionality. Future improvements include: (1) hierarchical trend models; (2) habitat association models; and (3) adaptive management evaluation.



<http://data.prbo.org/apps/pfss/>



Please go to the Pacific Flyway Shorebird Survey home page and select the “Explore Data” tab to test out the new shorebird data summary tool. If you have questions, recommendations, or general feedback contact Matt Reiter ([mreiter@prbo.org](mailto:mreiter@prbo.org)) at PRBO Conservation Science.

**THANK YOU!**



**CA Landscape Conservation Cooperative  
David and Lucile Packard Foundation**

**PFSS Partners**



This work would not have been possible without the generous support of the California LCC and the David and Lucile Packard Foundation. We also acknowledge the continued support and contribution of our many partners as part of the Pacific Flyway Shorebird Survey both within the CA LCC and beyond.



Contact:  
Matt Reiter  
mreiter@prbo.org

*“A coordinated, multi-partner monitoring program to quantify trends and habitat associations of wintering shorebirds in the Pacific Flyway.”*

<http://data.prbo.org/apps/pfss/>

Please contact Matt Reiter at PRBO Conservation Science with questions about this report or the Pacific Flyway Shorebird Survey.

Matthew Reiter  
PRBO Conservation Science  
P.O. Box 747  
Pescadero, CA 94060  
mreiter@prbo.org  
760-417-9997



## APPENDIX I:

### METHODS FOR PACIFIC FLYWAY SHOREBIRD SURVEY INTERACTIVE DATA SUMMARY TOOLS v. 1.0

This document provides details of the analyses used to summarize shorebird monitoring data as part of the Pacific Flyway Shorebird Survey (PFSS) Interactive Data Summary Tool v.1.0.

#### Summary Information

Data summaries are presented for each basic sampling unit and at the spatial and temporal scale selected by the user.

The following is a list of the features that are currently available through the Summary Information option:

- Relative abundance (proportion of total observed) of the six most common genera of shorebirds by spatial unit (user defined) and year (user defined)
- Relative abundance (proportion of total observed) of the six most common species by spatial unit (user defined) and year (user defined)
- Total number of shorebirds by spatial unit (user defined) and year (user defined).
- Total number of species of shorebirds by spatial unit (user defined) and year (user defined).
- Number of visits to the spatial units by year (user defined)
- Total number of shorebirds counted by sampling unit and year (user defined)
- Total number of species of shorebirds by sampling unit and year (user defined)

In these calculations, only surveys conducted during the Pacific Flyway Shorebird Survey window (November 10 – December 20) are used. Total abundance and number of species are calculated based on all visits (surveys) of the sampling unit within the survey window. Mixed flock codes are split into component species before numbers of species are estimated (see *Species Information* below).

#### Richness Information

##### Species Richness

Currently, we present the number of species of shorebirds per sampling unit and at the spatial and temporal scale selected by the user.

The following is a list of the features that are currently available:

- Average species richness per sampling unit surveyed for the user-defined spatial unit by year (Table and Graph output).
- Simple linear trend in richness estimates by user-defined spatial unit and year (Table and Graph output).

The richness estimate is calculated by first averaging counts of species across visits to sampling units (this is rarely done, as most sampling units are visited only once during the survey window), and then averaging within each spatial unit selected by the user. Mixed flock codes are split into component species before calculations are performed (see *Species Information* below).

## Density Information

### Species Density

This analysis reports the abundance of selected species per sampling unit surveyed, averaged across sampling units that make up the user-defined spatial unit (e.g. California, estuary). In these calculations, all visits within the survey window (November 15 – December 15) to each sampling unit are used, and counts of individuals are averaged over multiple visits. In all cases these results represent an index and not a true measure of density or abundance because they do not account for bias related to probability of detection (Royle et al. 2005). Direct comparisons between density estimates in different habitats should be interpreted with caution.

The following is a list of the features that are currently available (more features may be available soon):

- Density estimate (shorebirds per sampling unit surveyed) for the user defined species and spatial unit, by year (Table and Graph output).
- Simple linear trend in density estimates by user-defined spatial unit and year (Table and Graph output).

### Density Trend

If there is more than one year of data, the temporal trend in shorebird density is calculated using two approaches: (1) simple linear regression and (2) a LOESS smoother approach. Summary statistics and graphs are presented for density trend summaries.

- The linear trend is a simple linear regression using density estimates from all sampling units weighted by the inverse of the variance of the estimate. If any sampling unit density estimate contains a variance of 0, or if a variance could not be estimated then the trend is not weighted. Results include intercept and slope, with respective standard errors. The linear regression line is shown overlaid on the abundance graph.
- The LOESS trend is a smoothing regression technique using density estimates from all transects or locations. The advantage of this method is that it fits localized regressions within a moving window that slides through the entire time span of the data, so that the slope of the local regressions is estimated from points within the sliding window (i.e., not using the entire dataset). This allows for a finer-scale fit of the regression that provide additional insights for time-series data, because time series are typically composed of a trend and some seasonal factors or other sources of noise, and the trend can be better depicted with the localized regression method (Cleveland et al. 1990). Points closer to the center of the window are weighed more than points at both ends when fitting the localized regression. Results include intercept and slope with respective standard errors. The LOESS regression line is shown overlaid on the abundance graph. If the user-selected subset of data for which an estimate is to be

produced contains a mixed flock observation, all other observations of single species are rarefied to flock observations (see *Species Information* below).

### Species Information

Currently, this summary tool is applied to shorebird data only (Families: Charadriidae, Scolopacidae, Haematopodidae). Data on other species collected as part of some projects included in the Pacific Flyway Shorebird Survey are filtered out prior to analysis.

*How are mixed flocks handled for reporting data summaries, abundance and richness in the PFSS application?*

We define a mixed flock as an observation that comprises more than one species and thus is reported as a mixed flock taxon (e.g. XWLD = mixed flock of western sandpiper, least sandpiper, and dunlin). Although these mixed flocks are often necessary to use when recording large groups of shorebirds in the field, they affect the analysis of the data. We interpret their use in the PFSS data to mean one of two things: the observer detected several species with certainty and knowingly assigned them to a mixed flock taxon because a precise characterization of the number of individuals in each species was impractical, or the observer was unable to discern with precision the species composition of a flock and thus assigned it to a mixed flock. Unfortunately, we cannot tell which the case is when a mixed flock is reported. As a consequence, we use the following rules to report diversity and abundance in the analyses. It is important to remember that these rules are applied on the basis of what the user selects for analyses – the original data remain unchanged.

*Species richness:* If there is a mixed flock among the records selected, it counts for as many species as the flock comprises. If one of the species in the mixed flock already exists in the data as an independent observation, then it will not be double-counted.

Example: records for Date 1 include the mixed flock LGPL (2 species), and records for Date 2 include AMGP. These together indicate the presence of 2 species (because LGPL represents 2 species). If there was no AMGP detected on Date 2, the species count would still be 2.

*Species abundance:* The purpose of the abundance records is to compare between sites and across years. If anywhere in the sample selected by the user there is a mixed flock, all records of species in the flock will be re-assigned to the flock, so that abundance comparisons can be made for flock numbers across sites and years.

Example: On year 1 the counts report 2 AMGP and 10 LGPL, while on year 2 there were 4 LGPL. The abundance comparison will show 12 individuals of LGPL on year 1, and 4 individuals of LGPL on year 2.

*Data summaries:* The intent of the summaries is to describe the sample. No alterations will be made to the counts by taxa. However, when calculating the total species observed, if there is a mixed flock among the records selected, it counts for as many species as the flock comprises. If one of the species in the mixed flock already exists in the data as an independent observation, then it will not be double-counted.

**Literature Cited**

Cleveland, R. B., W. S. Cleveland, J. E. McRae, and I. Terpenning, 1990. STL: A seasonal-trend decomposition procedure based on loess. *J. Official Stat.*, 6(1):3-73.

Royle, J. A., J. D. Nichols, and M. Kery. 2005. Modelling occurrence and abundance of species when detection is imperfect. *Oikos* 110:353-359.