



Bird Survey of the Yosemite Transect - 2004

Overview -- In 2003, researchers from the MVZ began a systematic census of birds at sites in Yosemite National Park (YNP) originally visited by Joseph Grinnell and his colleagues between the years 1911 and 1919. Information regarding the locations, dates, and length of surveys was derived from the field notes of the original investigators. We performed variable distance point counts along transects representative of routes used by Grinnell et al. in their original censuses, and in most cases our transects overlapped exactly with the original routes. We set up 14 transects made up of a total of 212 points. We sampled each transect two to three times, for a total of 36 sampling days, detecting a total of 8547 individual birds.

In 2004, we continued this study. We revisited 7 of the 2003 transects (111 total points), and set up 13 new transects (made up of 200 points) within YNP and at Grinnell sites in the foothills to the west of YNP, for a total of 47 sampling days (33 days within YNP) (Fig. 1, Table 1). As in 2003, we performed variable distance point counts. In addition, however, we performed 16 line transect counts along these same transects. Line transects are more similar to the methods employed by Grinnell et al., and by comparing point counts and line transect counts made at the same transects in 2004, we hope to make a better comparison between our point count data and the Grinnell data. We sampled each new transect twice performing point counts, and once performing line transect counts. We detected 15879 total birds (8691 from point counts, 7188 from line transect counts) in 2004. In the combined 2003/2004 counts, we logged 146 total species. We tallied 135 species from the census data of Grinnell and his colleagues. There were 112 species in common to both surveys.

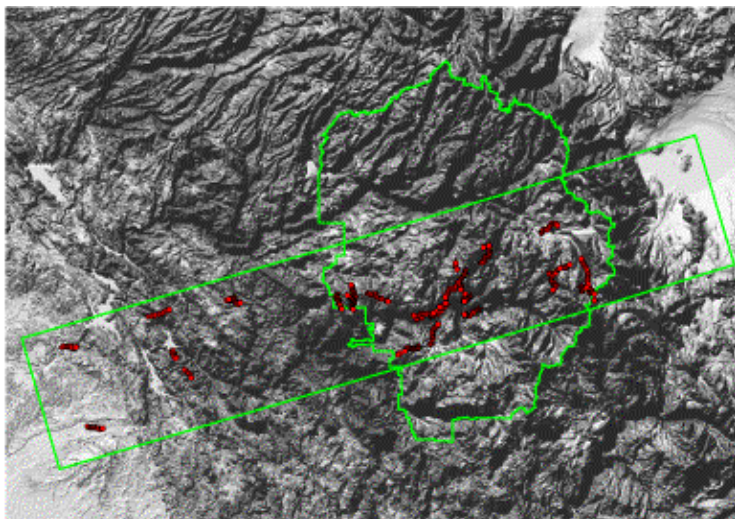


Fig. 1. Transects visited in 2004 by MVZ researchers in the Yosemite region. Yosemite National Park is outlined in green. The green rectangle outlines Grinnell's original Yosemite transect. The 2004 transects are comprised of a series of points (each point represented by a red circle).

A list of survey dates and locations from 2004.

Inside Yosemite National Park

Transect	Mean Elevation (m.)	Sample Date	Count Type
Chinquapin	2162	25 May 2004	Point Count
		02 Jun 2004	Line Transect

Crane Flat	1799	06 Jun 2004	Point Count
Donohue Pass	3221	22 Jul 2004	Point Count
Evelyn Lake	3167	13 Jul 2004	Point Count
		15 Jul 2004	Line Transect
		17 Jul 2004	Point Count
Indian Canyon	2212	06 Jun 2004	Point Count
		18 Jun 2004	Line Transect
		20 Jun 2004	Point Count
Lyell Fork Meadows	2750	21 Jul 2004	Point Count
		23 Jul 2004	Line Transect
Maclure Creek	3148	24 Jul 2004	Point Count
May Lake	2707	08 Jun 2004	Point Count
		21 Jun 2004	Line Transect
		23 Jun 2004	Point Count
McGurk Meadow	2135	11 Jun 2004	Point Count
		17 Jun 2004	Line Transect
Merced Grove	1707	10 May 2004	Point Count
		12 Jun 2004	Line Transect
North Yosemite Valley	1268	11 May 2004	Point Count
		23 May 2004	Line Transect
		04 Jun 2004	Point Count
Tamarack Flat	2050	24 May 2004	Point Count
		03 Jun 2004	Line Transect
		13 Jun 2004	Point Count
Tuolumne Meadows	2707	19 Jun 2004	Point Count
		22 Jun 2004	Line Transect
		24 Jun 2004	Point Count
Vogelsang Lake	3139	14 Jul 2004	Point Count
		16 Jul 2004	Line Transect
		18 Jul 2004	Point Count
Yosemite Valley	1232	10 Jun 2004	Point Count

Outside Yosemite National Park

Transect	Mean Elevation (m.)	Sample Date	Count Type
La Grange	57	03 May 2004	Point Count
		13 May 2004	Line Transect
		21 May 2004	Point Count
Snelling	83	04 May 2004	Point Count
		19 May 2004	Line Transect
Hunter Valley	692	06 May 2004	Point Count
		12 May 2004	Line Transect
		26 May 2004	Point Count
Penon Blanco	541	07 May 2004	Point Count

		14 May 2004	Line Transect
		22 May 2004	Point Count
Smith Creek	871	05 May 2004	Point Count
		20 May 2004	Line Transect
		27 May 2004	Point Count

In 2003, we reported significant changes in the abundance and distribution of certain bird species since Grinnell's time. The relative abundances of certain species had changed at specific sites and some species had shown an upward range expansion in elevation. Other species had apparently colonized YNP since Grinnell's time. In 2004, we continued to find similar changes and patterns, at sites previously sampled in 2003, and also at sites representing similar elevations and habitats as those sampled in 2003. A plot of the species abundance for the Grinnell surveys and for the 2003/2004 surveys shows a similar J-shaped curve in both cases, with the bulk of the individuals observed being comprised of relatively few abundant species (Fig. 3). The 2003/2004 distribution, however, shows greater numbers of individuals for the most common species. This could indicate that these common species have become more common during the intervening years, or it could be an indication of a difference in sampling effort. Both surveys detected similar numbers of species overall, and the long tail of the distribution made up of rare or hard to detect species converges in the plot of each survey period. It is possible, however, that the modern methodology used in 2003/2004 is more thorough than the original surveys in the sense that more time is spent counting along a similar route. This could result in a similar number of total species being found due to similarity in the total length of a given route, but the time spent intensively counting individuals in the 2003/2004 surveys could result in greater numbers of the more common species being counted.

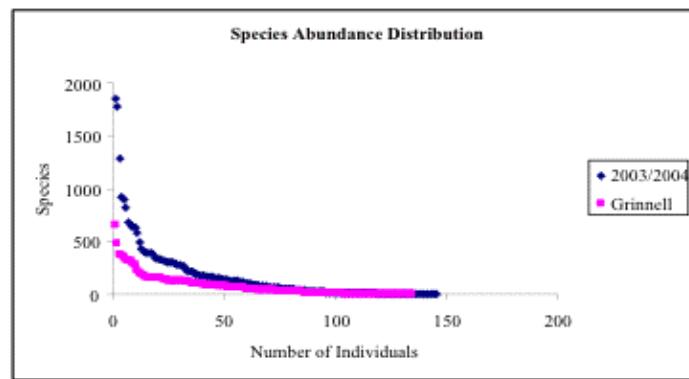


Fig. 3. Species abundance distribution plot for the original Grinnell surveys and for the 2003/2004 surveys.

Elevation is the principal environmental gradient along which both flora and fauna vary in the Sierra Nevada. Species richness showed a predictable decline with elevation for both the Grinnell survey data and for the 2003/2004 resurveys (Fig. 4). A plot of species richness by elevation for both surveys shows parallel decreasing trend over sites. Within this trend, however, we have observed evidence of species turnover at specific sites. Fig. 5 shows a plot of species detected at sites censused by both surveys. Species exclusive to the 2003/2004 surveys make up a greater proportion of the overall species detected at the higher elevation sites. It is also worth noting that with regard to sites surveyed in both 2003 and 2004, the number of Grinnell exclusives has decreased in most cases and the number of 2003/2004 exclusives has grown, while the number of species common to both studies has remained relatively stable. This could indicate changes in community structure at sites, with new species moving into sites where they were previously absent or rare. By extension, it could also indicate that the species exclusive to the Grinnell studies not found in either 2003 or 2004 may perhaps have become extremely rare or extirpated at these sites.

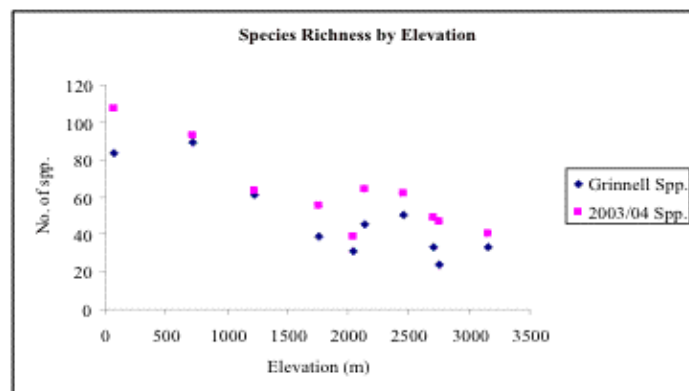


Fig. 4. Species richness plotted by elevation for the original Grinnell surveys and for the 2003/2004 surveys.

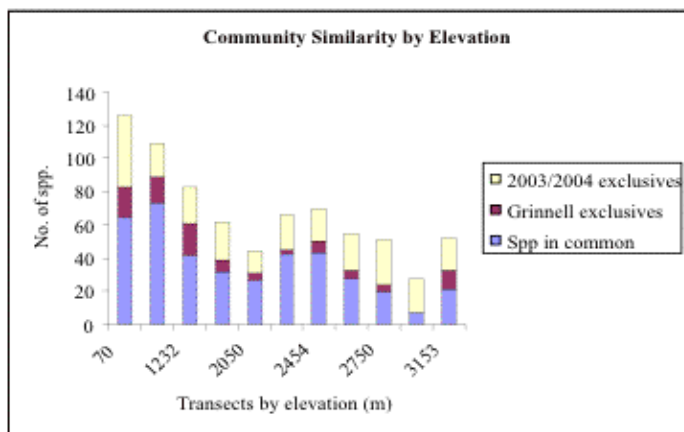


Fig. 5. A plot of community similarity by elevation. Elevations represent sampling sites visited by Grinnell et al. and in 2003/2004.

Species accumulation curves were plotted for three of the sites. These, as well as Chao 1 estimates of species richness at the sites predict a greater number of species per site from the 2003/2004 surveys in every case. Yosemite Valley was surveyed more times and over a longer period by Grinnell (1911-1919) than any other site in the study. It has also undergone the most dramatic habitat modifications since Grinnell's time, with ever increasing numbers of visitors and increased forestation. Fifty-nine species were detected during the 2003/2004 surveys, while Grinnell found 48 in his censuses. Both the Chao 1 estimate and the species accumulation curve predict a higher number of species for the Valley from the 2003/2004 counts (Fig. 6). The Chao 1 estimate for the species richness at the site based on the 2003/2004 surveys is 83, while the estimate from Grinnell's surveys is 48. These estimates seem to indicate that Grinnell's surveys were thorough in terms of detecting species in the Valley at the time, but that the more recent surveys have found only about 70% of the species at the site. Both the observed and predicted values from the 2003/2004 counts represent a large increase in species richness for the site as well as substantial species turnover. Twelve species found in the original surveys were not refound in 2003/2004, while 18 new species were found. Several species such as Cooper's and Sharp-shinned Hawks, Willow Flycatcher, and Swainson's Thrush are known to be absent or nearly so as breeders in Yosemite Valley. New species found in both the 2003 and 2004 surveys, unknown in Yosemite Valley in Grinnell's time include Common Raven, Song Sparrow, Brown-headed Cowbird, and Bullock's Oriole.

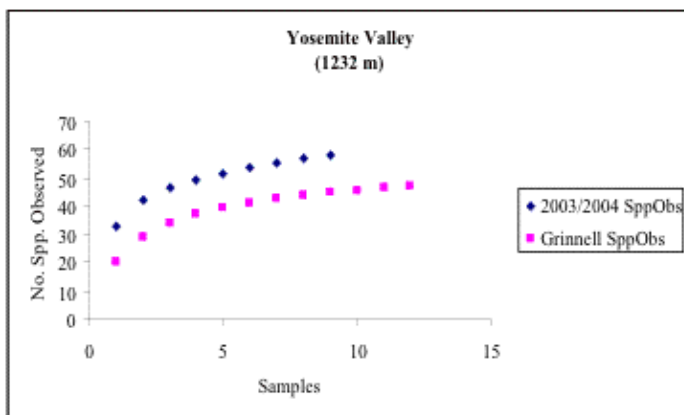


Fig. 6. Species accumulation curve for the Grinnell censuses and for the 2003/2004 censuses for Yosemite Valley.

Indian Canyon/Porcupine Flat is a site stretching from Yosemite Point to Porcupine Flat and May Lake. In order to cover the original routes in this area surveyed by Grinnell et al., we set up three transects in 2003/2004. These sites are lumped in this analysis because the original data overlaps, and it is impossible to differentiate between the individual transects. Habitat at this site seems to have remained relatively stable, having avoided some of the dramatic modifications and development at some of the more visited sites. Fifty-eight species were detected in the 2003/2004 surveys, while Grinnell et al. detected 43. Once again, both the species accumulation curve and the Chao 1 estimate a greater number of species for the site from the 2003/2004 data (Fig. 7). The Chao 1 estimate of species richness based on the 2003/2004 counts is 63 species, while that based on the Grinnell et al. counts is 45. These estimates are close to the actual number of species detected by each survey respectively, indicating thorough coverage in each case. This may indicate that the increase in the number of the species detected in the more recent surveys represents a real increase in species at the site rather than a result of greater sampling effort in the more recent surveys. It is hard to draw conclusions by examining the 7 species exclusive to the Grinnell et al. surveys or the 25 species exclusive to the 2003/2004 surveys. Ruby-crowned Kinglets, more common at several sites in Grinnell's time, were absent in 2003/2004. Common Ravens and Brewer's Blackbirds, found in 2003/2004, are new to the park or have shown dramatic increases respectively.

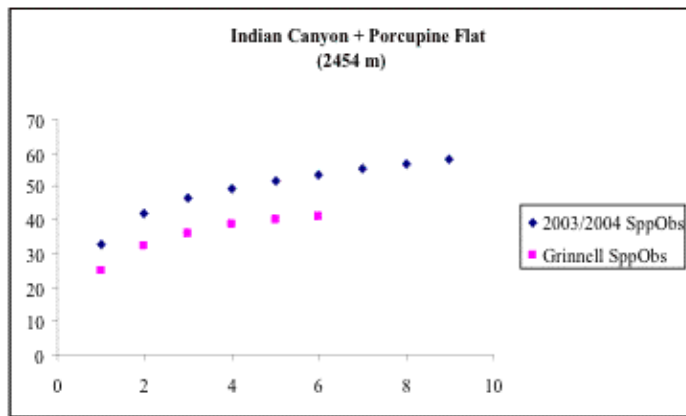


Fig. 7. Species accumulation curve for the Grinnell censuses and for the 2003/2004 censuses for Indian Canyon/Porcupine Flat.

Lyell Fork Meadows, the large meadow system along the Lyell Fork of the Tuolumne River in Lyell Canyon showed interesting changes in the 2003 surveys, with a number of species apparently colonizing the area as breeders. We revisited this site to see if we would find further evidence of movement of species into this area. Indeed, we continued to find species not documented in the original surveys, and these species seem to be similar to species exclusive to the 2003 counts in that they are riparian or wetland associated species. For example, in 2003, Blue-winged and Green-winged Teal were found in a wide marshy area of the Lyell Fork, both with fledglings. In addition, we found Warbling Vireos, Red-winged Blackbirds, and Song Sparrows—all related to some degree to wetland or riparian habitats. None of these species was found in the original surveys. All of these species, with the exception of the teal were refound in 2004. In the 2004 surveys, we added American Coots (with fledglings), Black Phoebes and Belted Kingfishers, all riparian/wetland birds new to the site. The species accumulation curves and the Chao 1 estimates predict a much larger number of species for the site based on the 2003/2004 surveys (Fig. 8). Forty-two species were found in the 2003/2004 surveys while 23 were found in the original surveys. The Chao 1 estimate of species richness based on the 2003/2004 surveys is 48, while that based on the Grinnell et al. surveys is 29.

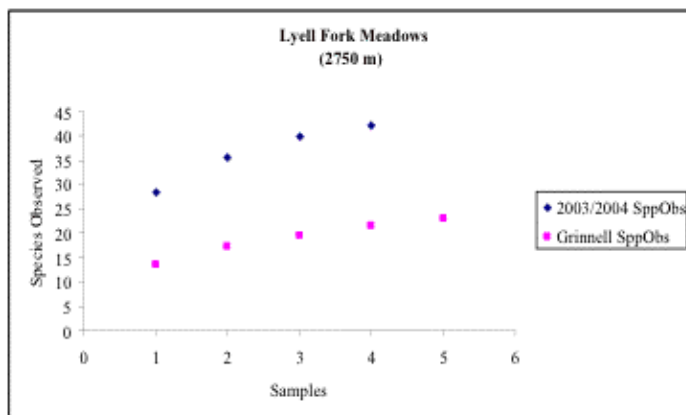


Fig. 8. Species accumulation curve for the Grinnell censuses and for the 2003/2004 censuses for Lyell Fork Meadows (Lyell Canyon).

Surveys were conducted in 2004 at Tuolumne Meadows as well. If this were considered part of a larger meadow system that includes the habitat along the Lyell Fork in Lyell Canyon, one would expect to find similar changes at both sites. In fact, several riparian/wetland-associated species unknown at the site in Grinnell's time were found at this site as well. Green-winged Teal, Mallards, Red-winged Blackbirds, and Song Sparrows were found in Tuolumne Meadows in 2004, as well as several territorial Warbling Vireos and Yellow Warblers, which remained throughout the survey period. None of these species was known from Grinnell's time. Taken with the species that have apparently colonized Lyell Canyon, these findings from Tuolumne Meadows could indicate a general trend of range expansion toward higher elevation for a suite of wetland/riparian species in the Yosemite region.

These analyses are preliminary and represent to some extent an exploration of the data. We are currently working on various ways to correct for differences in effort in Grinnell's surveys and our own. With a better assessment of species richness and abundance based on data corrected for effort, we hope to be able to differentiate between any differences due to differences in sample effort from those due to real changes in the abundance or community structure of the birds.