The North American Breeding Bird Survey

1966 - 2009

Summary Analysis and Species Accounts

Introduction

The North American Breeding Bird Survey (BBS) is a unique collaborative effort to increase our understanding of North American bird populations. Started at a time when concern about bird populations was focused on pesticide effects, the BBS is now used as the primary data source for estimation of population change and modeling of the possible consequences of change in land use, climate, and many other possible stressors on bird populations. Jointly coordinated by the United States Geological Survey and the Canadian Wildlife Service, the BBS incorporates the efforts of thousands of volunteer bird counters across the Unites States and Canada. From their efforts, comprehensive summaries of population change have been calculated for >400 species of birds (Sauer et al 2003). For most of these species, the BBS forms the only basis of our understanding of the dynamics of the populations. It has also had a strong effect on the avocation of birding, as the knowledge requirements for conducting a breeding bird survey provides a standard for competence in identifying birds by sight and sound. Although it has limitations, no other survey comes close in combining public participation and scientific rigor to

provide information for bird conservation and natural history. As scientists who use the information from the survey, we acknowledge our debt to Chandler Robbins (Figure 1), who had the vision and energy to develop and implement the survey and remains its greatest advocate, the coordinators who have augmented the program and maintained the information, and the thousands of volunteers who conduct the surveys and dutifully submit the information to be analyzed and presented to the world.

Figure 1. Chan Robbins counting birds at a BBS stop

This summary of BBS results presents a synthesis of information on bird population change and distribution. We inaugurate the first operational analysis of the BBS dataset using hierarchical log-linear models to estimate population change. We integrate information on the habitats and life history of the species with current estimates of population change, maps of distribution and population change, and graphs showing change to provide species accounts for 419 species of North American birds. These species-by-species summaries provide a concise description of both population status and the credibility of the survey in providing population change information for the species. We also present analyses of species groups to summarize patterns of population change for collections of species of conservation interest. By providing a survey-wide overview of species coverage in the survey, this volume compliments earlier comprehensive summaries of the BBS (Robbins et al. 1986, Sauer et al. 2003) that provided summaries of earlier analyses. Detailed regional information regarding population change for all species are available on the BBS Summary and analysis website (Sauer et al. 2010).

A Brief History of the North American Breeding Bird Survey

The North American Breeding Bird Survey (BBS) was developed in response to a need for better information about population change in songbirds in North America. Legal requirements for management of harvested species led to development in the 1950s of continent-scale surveys for waterfowl (Martin et al. 1979), but no such surveys existed for nongame birds. However, publication of Rachel Carson's *Silent Spring* (Carson 1962) raised public awareness of threats to songbird and other nongame bird populations; it was evident that we simply did not know very much about populations of most bird species and therefore could not assess the consequences of pesticides and other stressors for these species.

Chandler Robbins, who was already a distinguished researcher in bird populations at the Patuxent Wildlife Research Center in Laurel, MD, was able to convince his superiors in the US Fish and Wildlife Service that a continent-scale monitoring program for nongame birds was needed. Along with other researchers, Chan had been experimenting with roadside-based surveys for Mourning Doves and American Woodcock, which are both harvested species and therefore had been priority species for monitoring. Chan realized that, if competent observers could be recruited, the counting methodologies for doves could be modified to simultaneously count many species. He experimented with alternative approaches to counting birds for several years before settling on the protocol still used today of 3 minute roadside counts along a 24.5 mile-long survey route. He implemented the survey in Maryland and Delaware in 1965, and expanded the survey to sample the eastern United States in 1966. Canadian collaborators, particularly Anthony Erskine, implemented the survey in southern Canada in 1967. Survey routes were established in the Central United States in 1967, and the survey was established across the continental United States by 1968. Since 1968, additional survey routes have been established, with efforts to get better information from remote regions of the western US and northern Canada. Although generally not analyzed with the rest of the data due to a more limited area and series of years of coverage, Alaska now has many BBS routes as well as a research-based off-road survey. BBS-style surveys are also now conducted in Puerto Rico, and routes have been surveyed in Mexico.

By 2009, there were >5100 survey routes in the database , and >2,500 of them are surveyed each year. Coverage varies across North America, with fewer routes in the western United States and very few in northern Canada (Figure 2).

Figure 2. Map of route locations in the continental United States and southern Canada

Field Methods of the Breeding Bird Survey

Breeding Bird Surveys are conducted along roadside survey routes, generally by volunteer bird watchers who have demonstrated an ability to identify birds both visually and by song. The observer selects a morning in June (Late May dates are allowed in southern states; Early July dates are allowed in northern provinces) to conduct their survey.

The roadside routes consist of 50 stops. The observer drives the route, identifying the stop locations and parking the car in a safe pull-off. USGS topographic maps are generally provided to observers to assist them in finding stops, along with written stop descriptions and GPS locations on some routes (Figure 3). Surveys start 30 minutes before local sunrise, and stops are 800 m (0.5 mi) apart.

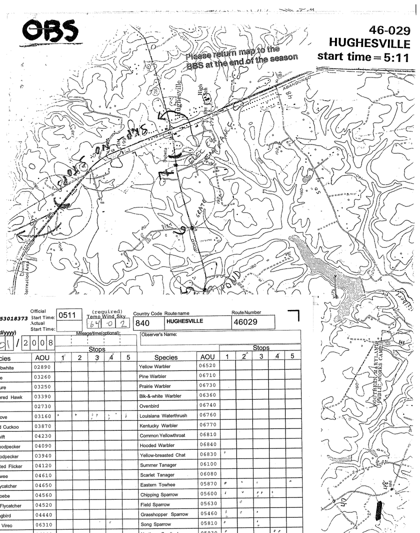
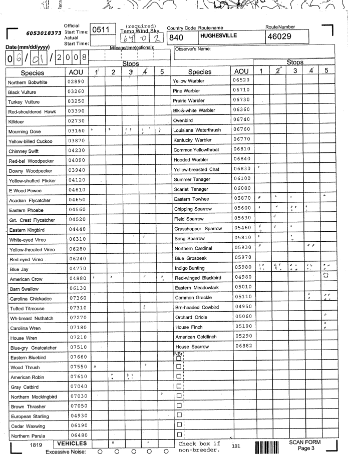


Figure 3. Stop locations on field map used in BBS.



At each stop, the observer exits of the vehicle and conducts a 3-min count, recording all birds heard and birds seen within a 400 m (0.25 mi) radius-area around the point during the counting period (Figure 4). The same stops are surveyed each year to ensure consistency in sampling. Supplemental information regarding disturbance (number of cars that pass the stop during the count period), weather, and other data are collected during the survey.

Figure 4. BBS field data sheet.

After conducting the surveys, observers submit their data to either the United States or the Canadian BBS coordinators, who edit the data and make it available to the public both as data and in summary form via the internet. Data, protocols for conducting the survey and additional details regarding the survey are available on the BBS operations website (http://www.pwrc.usgs.gov/bbs/).

Analysis Methods

Statistical analysis of BBS data can be controversial, as complications associated with the nature of the count data and the scale of the survey limit the application of standard sample survey methods (e.g., Sauer et al. 2004). The survey routes sample local populations, and inference regarding population change at regional scales requires (1) accommodation of repeated counts of the survey over years on routes; (2) inequities in numbers of samples among regions, (3) missing data on routes, and (4) controlling for changes in the BBS index associated with changes in detectability. The issue of detectability, and the consequences of changes in detectability on inference regarding population change, has been a source of controversy from the start of the BBS. Because observers miss a portion of birds when counting, and no means exists to directly estimate the fraction of birds missed during counting, controlling for factors that influence the proportion of birds counted is a critical component of the analysis. Observer differences in counting ability are well-known to influence detectability (e.g., Sauer et al. 1994, Kendall et al. 1996), and most analyses of BBS data have controlled for observer effects on counts (e.g., Sauer et al. 2008).

Innovations in analyses of BBS data reflect the advances in computers and statistical methods over the period 1966-2010. In early years of the survey, file storage and computational limitations constrained analyses to methods such as route regression that could be implemented on available computers. Modern computer-intensive approaches such as the hierarchical models presented here provide many opportunities for analyses that more realistically model the multi-scale, repeated-measure nature of the survey.

It was evident from the earliest BBS summaries that comparisons of simple means of counts within regions were an inadequate summary of abundance and population change, as missing data introduced spurious patterns in change in abundance (Geissler and Noon 1981, Robbins et al. 1986). To control for effects of missing data, early summaries of BBS data relied on methods that analyzed population change from subsets of data that were “comparable” over time, i.e., the routes that were consistently surveyed by the same observers. Unfortunately, methods that estimate change from ratios of counts at different times from small samples of comparable routes produce biased estimates (Geissler and Noon 1981). Geissler and Noon (1981) suggested a route-regression analysis, in which linear regression is used to estimate change on individual survey routes and regional trends are computed as an average of these route change estimates. In early applications, (Robbins et al. 1986, Geissler and Sauer 1991) route regression was based on a normal regression with natural-logarithm transformed counts with a 0.5 constant added to accommodate zero counts. However, count data from the BBS are more naturally modeled as a generalized linear model, and Link and Sauer (2004) defined a Poisson regression with log links fit using Estimating Equations. In both analyses the goal was estimation of change (the slope associated with time) with time and categorical observer data as predictors of the counts. The analysis controlled for observer effects, effectively allowing a different intercept for each observer in the analysis (Link and Sauer 1994). Interval-specific estimates of change (trend) for a region was estimated as a weighted average of the route slopes for the interval of interest, with mean abundance and survey consistency used as route-specific weights and an area weight was also included to accommodate regional differences in sample frames in multi-strata analyses. Variances of these trend estimates were estimated by bootstrapping. See Geissler and Sauer (1990) and Link and Sauer (1994) for additional information about the route-regression method and the weighting factors. Additional analyses estimated annual indices from residual variation associated with yearly data around the predicted trends (Sauer and Geissler 1991).

Route regression proved to be a robust approach for estimation of population change (Thomas 1996), but had clear limitations. The route-by-route summaries of change, although convenient computationally, had no direct controlling for interval-specific variation in the quality of information. Because there was no way to determine whether route in a region adequately represented the interval, a trend may have been based on a preponderance of data from early or late in the interval. The weightings, although constructed to permit estimation of change for the total population, were criticized because the quantities were on ad-hoc approximations of unknown quantities (ter Braak et al. 1994). Estimation was focused on trend, and annual indices were computed as residuals of the estimated trends (Sauer and Geissler 1991), hence annual indices were also subject to these criticisms.

Hierarchical Model Analysis

Hierarchical models provide a comprehensive framework for estimating population change and annual indices of abundance from BBS data. Hierarchical models are a class of generalized linear mixed models that permit year, stratum, and observer effects are governed by parameters that are random variables. This hierarchical structure allows us to model the influence of regions, observers, and other factors on the distributions of the parameters influencing counts, rather than on the counts themselves. Using these models, we can formulate regional summaries in terms of model parameters, avoiding the ad-hoc weightings used in the route-regression approach. See Link and Sauer (2002) and Sauer and Link (2002) for details of these analyses and the philosophical approaches to regional models of bird population change.

Hierarchical models are often fit using a Bayesian approach, in which inference is based on the posterior distributions of parameters. Bayesian analyses require specification of prior distributions of parameters and the sampling distributions of the data. Although most realistic Bayesian analyses are difficult to solve analytically, simulation-based Markov chain Monte Carlo methods (MCMC, Lunn et al. 2000) can be used to approximate the distributions. Using MCMC, a posterior distribution can be calculated for many complicated models, and the iterative results from the procedure can be used to calculate means, medians, and credible intervals (Bayesian confidence intervals) from the posterior distributions of the parameters of interest. Link and Barker (2010) discussed the methods and philosophical basis of Bayesian inference.

In the BBS hierarchical model, counts $Y_{i,j,k}$ (*i* indexes stratum, *j* for unique combinations of route and observer, and *t* for year) were assumed to be independent Poisson random variables with means $\lambda_{i,j,t}$ that can be described by loglinear functions of explanatory variables,

$$\log(\lambda_{i,j,t}) = S_i + \beta_i(t - t^*) + \omega_j + \gamma_{i,t} + \varepsilon_{i,j,t}; \quad \textbf{(1)}$$

Which are stratum-specific intercepts (*S)*, slopes (β), and effects for observer/route combinations (ω), year (γ) and overdispersion effects (ε). The model required specification of distributions for parameters. In our analysis, S_i and β_i were given diffuse (essentially flat) normal distributions, and other effects were specified as having mean zero normal distributions. Observer/route effects (ω) were identically distributed, with common variance σ^2_ω and overdispersion effects (ε) were identically distributed with common variance σ^2_ε Variance of the year effects (γ) was allowed to vary among strata ($\sigma^2_{\gamma,i}$). All variances were assumed to have flat inverse gamma distributions.

From the model parameters, annual indices of abundance and trend were defined as derived parameters. Stratum-specific annual indices of abundance ($n_{i,t}$, an index to the number of birds per route in stratum *i* at year *t*) were year effects, stratum, and trend effects with associated variance components, summed and exponentiated.

$$n_{i,t} = \exp\left(S_i + \beta_i(t - t^*) + \gamma_{i,t} + 0.5\sigma^2_\omega + 0.5\sigma^2_\varepsilon \right);$$

Stratum totals were $N_{i,t} = A_i \, n_{i,t}$, where A_i is the area of the stratum. To obtain indices for larger areas (groups of strata, e.g., states, BCRs, countries), we sumed the $N_{i,t}$ over the relevant *i*. For presentation, we scaled the composite indices N_t by the total areas, obtaining a summary on the scale of birds per route, $n_t = N_t \,/\, \sum_i A_i$.

We defined trend as an interval-specific geometric mean of proportional changes in population size, expressed as a percentage (c.f., Link and Sauer 1998). Thus the trend from year t_a to year t_b for stratum *i* was $100(B_i - 1)\%$, where

$$B_i = \left\{ \frac{n_{i,t_b}}{n_{i,t_a}} \right\}^{\frac{1}{t_b - t_a}} .$$

The composite trend $\overline{B}$ was calculated analogously as $100(\overline{B} - 1)\%$, using the composite indices $N_t = \sum_i N_{i,t}$,

$$\overline{B} = \left\{ \frac{N_{t_b}}{N_{t_a}} \right\}^{\frac{1}{t_b - t_a}} .$$

The definition of trends presented above is interval-specific, and is applicable for estimation of change for any interval. However, many alternative definitions of trend exist, and some investigators prefer a definition of trend as the slope of a regression line through annual indices (e.g., Thomas et al. 2007). To document the consequences of alternative definitions of trend, we estimated trend as the slope of a linear regression with time as a predictor and log-transformed annual indices as the dependent variable. This definition of trend was implemented as a derived statistic in the MCMC summaries by calculating a linear regression through the annual indices from each iteration and calculating the percentage change from the estimated slope parameter associated with year. As with other posterior distributions, median slopes credible intervals were calculated directly from the MCMC results.

The program WinBUGS (Lunn et al. 2000) was used to fit this model for states and strata. We used WinBUGS and FORTRAN programs to conduct the MCMC analysis, evaluate summary statistics to determine when the Markov Chains became stationary, and summarize results. The MCMC analysis was iterative. We ran the analysis for at least 20,000 iterations to ensure stationary results, then ran another 20,000 analysis to obtain results for estimating the posterior distributions. Some species required additional iterations before usable estimates were obtained; for others, the large data sets proved difficult to manage are we could only summarize 10,000 replicates. For summary, we used every results from every second iteration ("thinned" by 2) to calculate estimates and credible intervals. We also output the MCMC replicates for additional summaries.

The hierarchical model requires sufficient samples across the time period of interest to allow estimation of the time series. Regions with very small samples, or with data that do not span the interval of interest, produced very imprecise results, and occasionally inclusion of these results led to extremely imprecise regional estimates. In those cases, we removed the region that produced the imprecision and reran the regional analysis. The eliminated regions are noted in the species accounts.

Following a comparative analysis of BBS data we now use BCRs as our strata (cf., Sauer et al. 2003). Because the BBS was originally stratified and coordinated within states and provinces, we retained the states and provinces as a component of the stratification, and estimated population change for BCR regions within states or provinces as our fundamental strata, and aggregated these regions to estimate composite trends within states/ provinces, BCRs, and larger scale regions.

Maps

We have been mapping relative abundance and population change from BBS data for over a decade, and several generations of our maps have been provided to users via the internet (e.g, Sauer et al. 2007). Here, we update these maps using current data to provide a context for the overall trend estimates and summary range information. The maps show where birds tend to be most abundant, indicate regional patterns of abundance, show the boundaries of the surveyed area, and provide a view of population change that is not constrained by the formal strata used in the hierarchical model analysis. As a summary of spatial patterns in the data, the maps provide an alternative to the more rigorous estimates of regional change provided by hierarchical models. Isaaks and Srivastava (1989) suggest that summary countour maps be viewed “as helpful qualitative displays with little quantitative significance.” Their context of discussion was geological data, but the comment is likely at least as relevant for maps of bird survey data from the BBS (Sauer et al. 2005).

Abundance Maps

Many investigators have used bird survey data to develop contour maps of bird abundance based on mean counts on survey routes. Root (1988) provided a grid of smoothed relative abundances for species observed on Christmas Bird Counts. Sauer and Droege (1989) mapped relative abundances of Eastern Bluebirds (*Sialia sialis*) just after severe winters in the mid 1970's and after their populations returned to pre-winter levels. We have also used relative abundance maps to document the ranges of species (e.g., Sauer et al. 2007, Droege and Sauer 1990). See Sauer et al. (1995) for applications and discussions regarding mapping of survey data.

We present maps as descriptive summaries of abundance over space. These maps are based on simple averages of counts on routes over time. Although similar data have been used as the basis of population estimates from BBS data, we caution readers that these simple averages do not account for observer differences in counting ability or for other factors such roadside counting effects, time of day effects, or species-specific effective survey areas (Thogmartin et al. 2006). We also note that the BBS data are edited to remove data that are of questionable quality or represent birds that are thought to be migrating rather than breeding; edges of ranges from these maps thus exclude observations of birds considered to be nonbreeding.

To construct the maps, we used the centerpoints of BBS routes, taken from digitized route paths (Sauer et al. 2007), as the geographic location of the survey route. Although BBS route are 39.4 km in length, centerpoints of the route path have been used to characterize route locations in geographic analyses (e.g., Flather and Sauer 1996). Abundance of birds of each species on the routes was estimated as an average of counts on the route from the interval 2005 - 2009. We used inverse distancing (Isaaks and Srivastava 1989) to interpolate estimated abundances for the map. This procedure estimates the abundance at a location as a distance-weighted average of counts from nearby survey routes. The distance weighting places more influence on nearby routes. We used inverse distancing to estimate abundances for an evenly-spaced grid of points overlaid on the survey area from the nearest 15 survey routes, then displayed the predicted abundances for each cell in the grid as our map. The grid was created in Arc/Info (Environmental Systems Research Institute 1991); covering the BBS survey area (excluding Alaska), grid cells had sides of length 21,475 m. The geographic coordinates of the center of each grid cell was calculated, and bird abundances were predicted for these locations. We then associated the predicted abundances with the grid, categorized the abundances as: 0.05 - 1, 1- 3, 3 - 10, 10 - 30, and 30-100, and >100 and shaded the map by successively darker reds in each category. The minimum level of 0.05 was chosen as a possible edge-of-range index after some comparisons of contours with known edges of ranges (S. Droege and D. Bystrak, Personal Communication), and the larger cutpoints were chosen as a series of powers of 3, rounded up for ease of presentation.

Population Change Maps

Population change maps were also based on predictions at the grid centerpoints. For each species, we estimated population change for a grid cell using a route regression analysis on nearby routes. Population change was estimated on each route using the estimating equations approach, and grid cell trends were estimated as an abundance and precision-weighted average of trend estimates from the nearest 15 routes. The maps thus display estimated trend (%/yr) for the entire survey period (1966 – 2009). Unlike the abundance-weighting, we did not inverse-distance weight the route trend estimates, as a preliminary analyses indicated existing weights provided a reasonable smoothing of the population change estimates. Estimated population change (%/yr) was categorized as < -1.5, -1.5 - -0.25, -0.25 – 0.25, 0.25 – 1.5 , and > 1.5. To prevent extrapolation of trends beyond the species ranges, population change was only displayed for grid cells where the estimated abundance was > 0.05.

Proportion of Bird Species Ranges in BBS Area.

We used the relative abundance maps to define the proportion of range surveyed by the BBS for each bird species. The maps, when constrained by predefined edges of survey coverage, provided an estimate of the area of the species range that is covered by the BBS. We developed a northern edge of the surveyed BBS area by buffering the centerpoint of BBS routes with a 12.5 mi circle, then drew a line along the northern edge of these buffers. This edge appears on our summary maps; the area to the north of the survey region is stippled on this map. The southern edge of the survey was considered to be the southern edge of the United States of America (California, Arizona, New Mexico, and Texas).

Range maps prepared by NatureServe (Ridgely et al. 2007, http://www.natureserve.org/getData/birdMaps.jsp) were used to calculate the area of the total range for each species. The NatureServe range maps were overlain on the BBS abundance maps, and the proportion of the total range covered by the BBS was calculated. Because the NatureServe maps do not contain relative abundance information, we could not calculate the proportion of the total species population surveyed by the BBS. Our metric only reflects proportion of range covered by the survey.

Presentation of Results

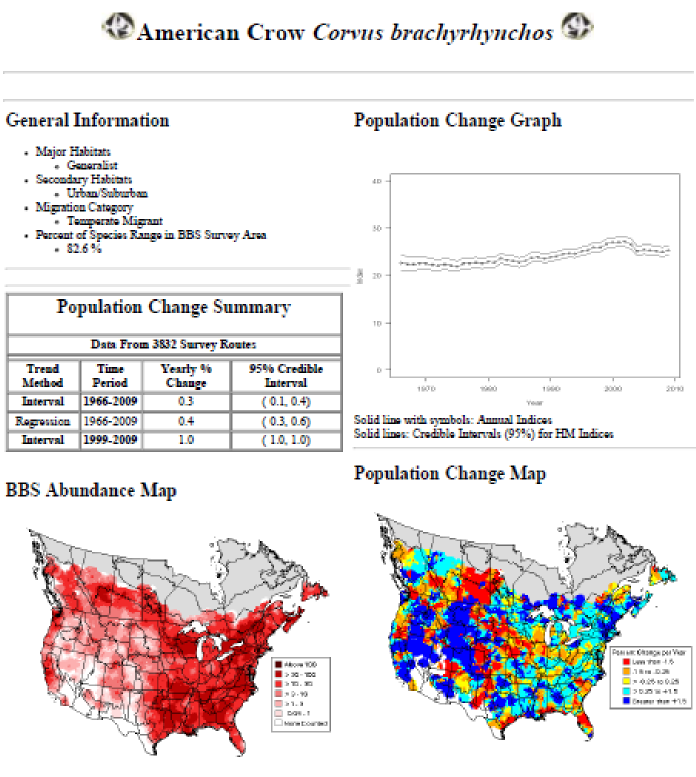
This work summarizes the most recent analysis of BBS data and provides updates regarding the summaries of species groups. Results are presented species-by-species as **Species Accounts**, and for summary **"State of the Birds" Species Groups** as defined by the US NABCI Committee (2009).

In these results, we focus on presentation of quantitative results and identification of possible concerns associated with the analysis. In recent years, we have cautioned users of BBS data to be aware of deficiences in the analysis of change associated with (1) limited data, due to either very small sample sizes or limited survey information from the species range; (2) low abundance species, as reflected on low relative abundances on BBS routes; (3) imprecise results, indicating poor ability to evaluate population change; and (4) inconsistency on change estimates over time (e.g., Sauer et al. 2003, http://www.mbr-pwrc.usgs.gov/bbs/cred.html). Sauer et al. (2003) summarized the frequency of these deficiencies for several groups of species. In our species accounts, we indicate when limited data and imprecise results occur in the hierarchical model analysis.

One issue of particular relevance for interpreting results from the hierarchical model analysis is precision. The HM analyses clearly show the imprecision associated with many species estimates of change and annual indexes. In particular, many regions had limited samples in the early years of the survey, hence indices from those earlier years have large credible intervals. This was not evident in earlier analysis, and the Estimating Equations analysis, which does not control for limited data in early years, often provided misleading views of change for species with limited data in early (or later) years (Link and Sauer 2002). Imprecise estimates have always been an issue for the BBS; this analysis for the first time provides users appropriate information regarding precision of indexes and trends over time.

Species Accounts

We summarized the information for each species in species accounts, from which maps and graphs of population change can be compared with estimates of change derived from the hierarchical model and estimating equations analysis. We also provide some grouped species summaries for species that have been taxonomically lumped and split over the BBS survey interval.



Information Presented In Species Accounts

The accounts contain (1) **General Information**; (2) **Population Change Summary** results; (3) **Abundance Maps**; (4) **Population Change Graphs**; and (5) **Population Change Maps**.

1. The general information about the species draws primarily on information developed for the 2009 State of North American Birds Report (U.S. NABCI Committee 2009). In this report, birds were grouped in major biomes, and some species were categorized as habitat obligates in the biomes.

- The major habitat (ecoregion) of occurrence for the species. The report categorized birds by major North American ecoregion (Marsh, Oceans, Arctic, Grasslands, Aridlands, Forests –[Boreal Forests, Western Forests, Eastern Forests, Subtropical Forests] and Generalists (occurring in >3 major habitats).

- Habitat Obligates are species that only occur in their primary ecoregion.
- Secondary habitats are habitats that occur in all ecoregions, and include Wetland and Urban/suburban species, and species that occur along coasts.
- Birds of Conservation Concern are species that occur on either the National Audubon Society watchlist (Butcher et al. 2007), the FWS list of species of conservation concern (US Fish and Wildlife Service 2008), or the endangered species list.
- Migration status was categorized as Permanent Resident, Temperate Migrant, or Neotropical Migrant.
- Exotic (nonnative) species were not categorized by habitat
- The percent of the species range occurring in the BBS survey area is presented.

2. Survey-wide population change of the long-term (1966-2009) and most recent 10 years is presented, along with 95% credible (or confidence) intervals. If the credible interval does not contain 0.0, we judge the trend estimate to be significant. We also present the long-term change estimate based on regression through the annual indices. We use colors to indicate cautions associated with results. Green text represents a need for caution in interpretation of results (e.g., due to low abundances or small samples); Red text suggests that a serious deficiency exists in the results. Additional statistics include:

- Sample sizes; the number of standard BBS routes on which the species was seen. Small sample sizes (<50) are flagged for caution. Very small samples (<14) are flagged as possibly unreliable.
- If the estimated trends are imprecise or extremely imprecise, we note the need for caution in interpretation.

3. Relative abundance maps are based on BBS data for the interval 2004-1008. Data were averaged by route, then smoothed using an area-weighted averaging. Note that the stippled area

in the northern part of the continent represents areas not covered by the BBS. BBS data from Alaska and Mexico are not included in the maps.

4. Time-series graph showing annual indices estimated using the hierarchical model. Median is shown as solid lines with year markers; lower (2.5%) and upper (97.5%) credible intervals are shown as solid lines.

5. Map of population change for BBS survey area were produced using a modified route regression analysis to produce weighted averages of local population change.

Regional Information

In addition to the survey-wide results described in the survey page, additional information is presented regarding regional patterns of population change: We present a table for each species that contains the trend results for Bird Conservation Regions and states and Provinces. For each of these regions, the hierarchical model-based trends are provided for 1966-2009 and 2000-2009 intervals. Symbols are used to indicate if the trends are imprecise (“V”), or if the shorter interval trends differ from the long-term trends (D). For species prioritized by Partners in Flight species prioritization efforts (Punjabi et al. 2005) we also provide columns for the BCR data to indicate the proportion of the population in each BCR and whether the species of management concern in the region. These columns are set of 0 or blank for Mountain Plover, as it was not ranked by Partners in Flight.

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Mountain Plover *Charadrius montanus*

General Information

- Major Habitats
  - Grassland
  - Habitat Obligate
- Watchlist/BCC Species
- Migration Category
  - Temperate Migrant
- Percent of Species Range in BBS Survey Area
  - 100.0 %

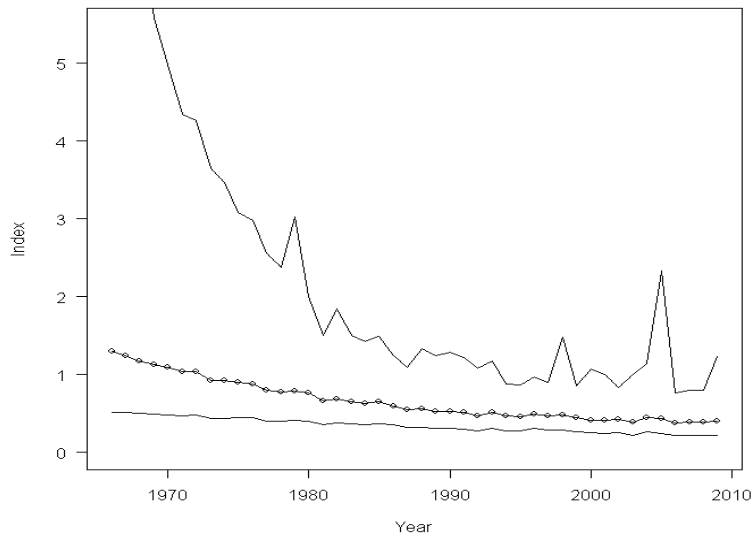
Population Change Summary

Data From 80 Survey Routes

Imprecise Results

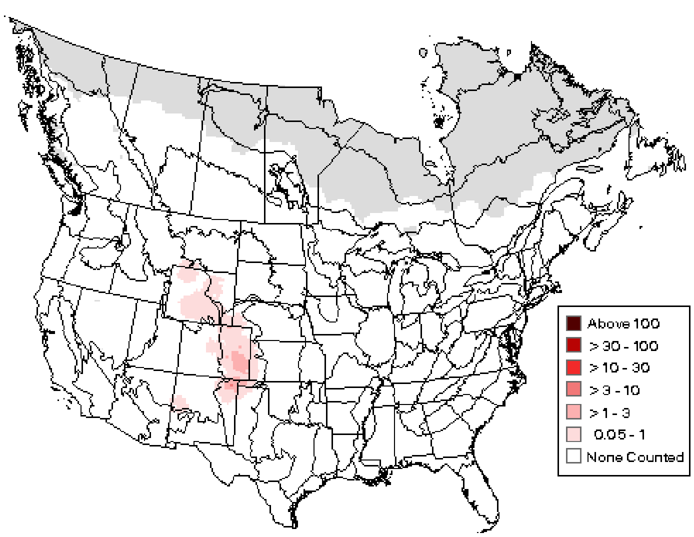
Trend Method	Time Period	Yearly % Change	95% Credible Interval
Interval	**1966-2009**	-2.6	(-6.7, 0.6)
Regression	1966-2009	-2.6	(-5.9, -0.2)
Interval	**1999-2009**	-1.1	(-5.8, 9.6)

Population Change Graph

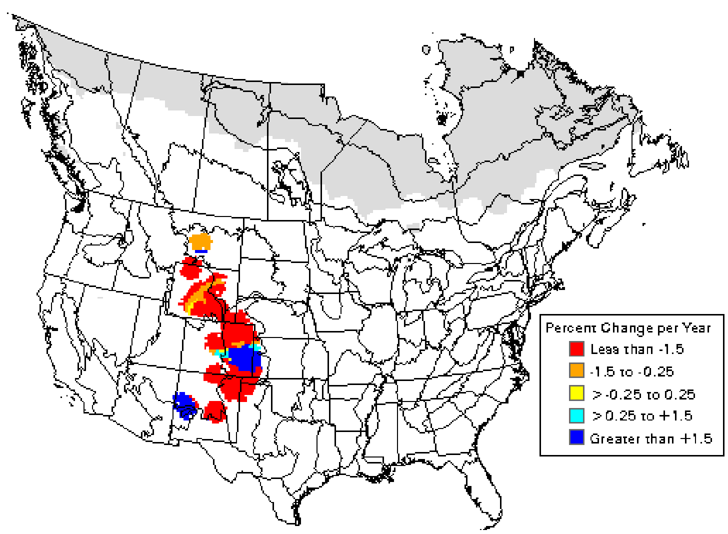


Solid line with symbols: Annual Indices
Solid lines: Credible Intervals (95%) for HM Indices

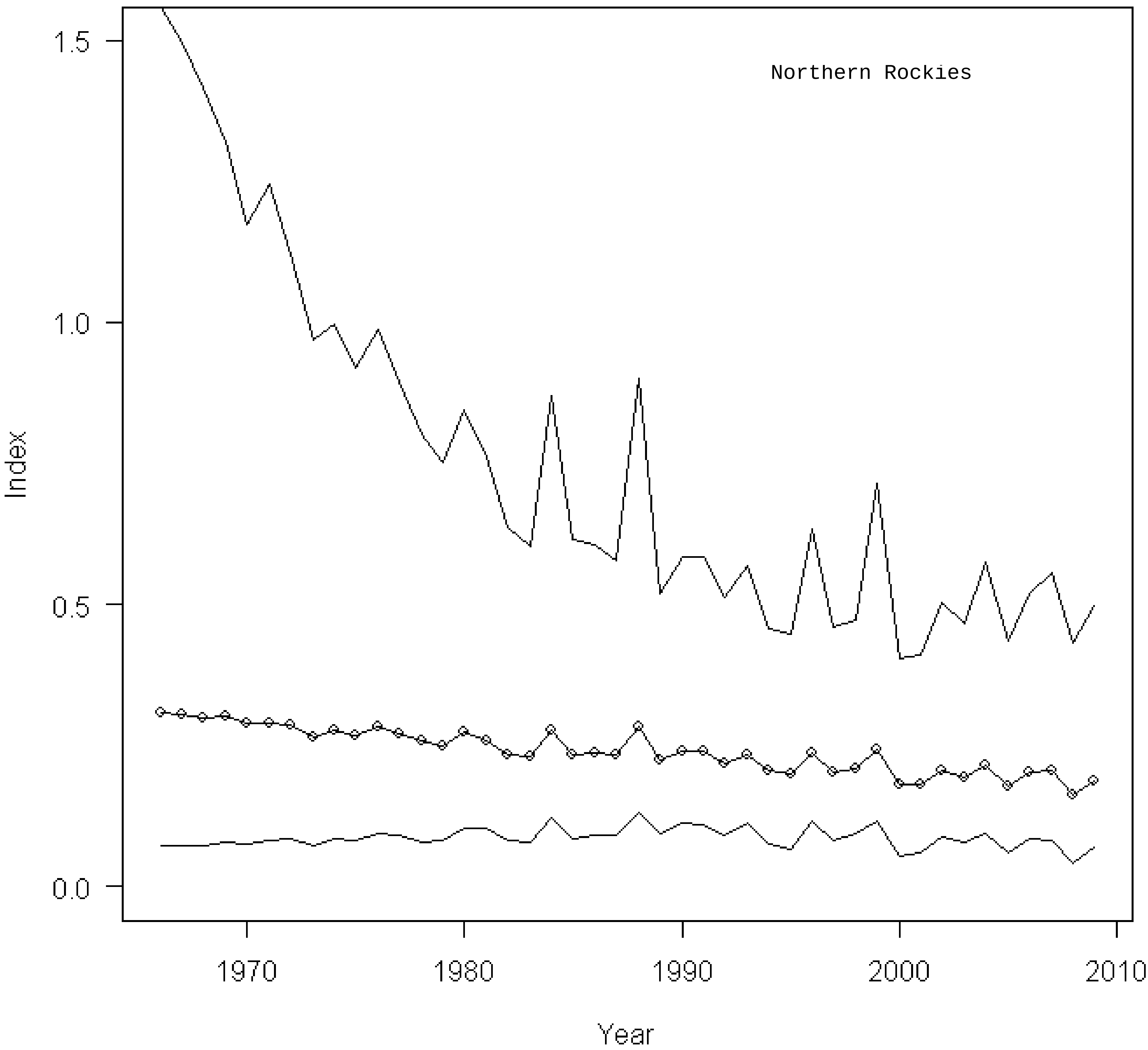
BBS Abundance Map

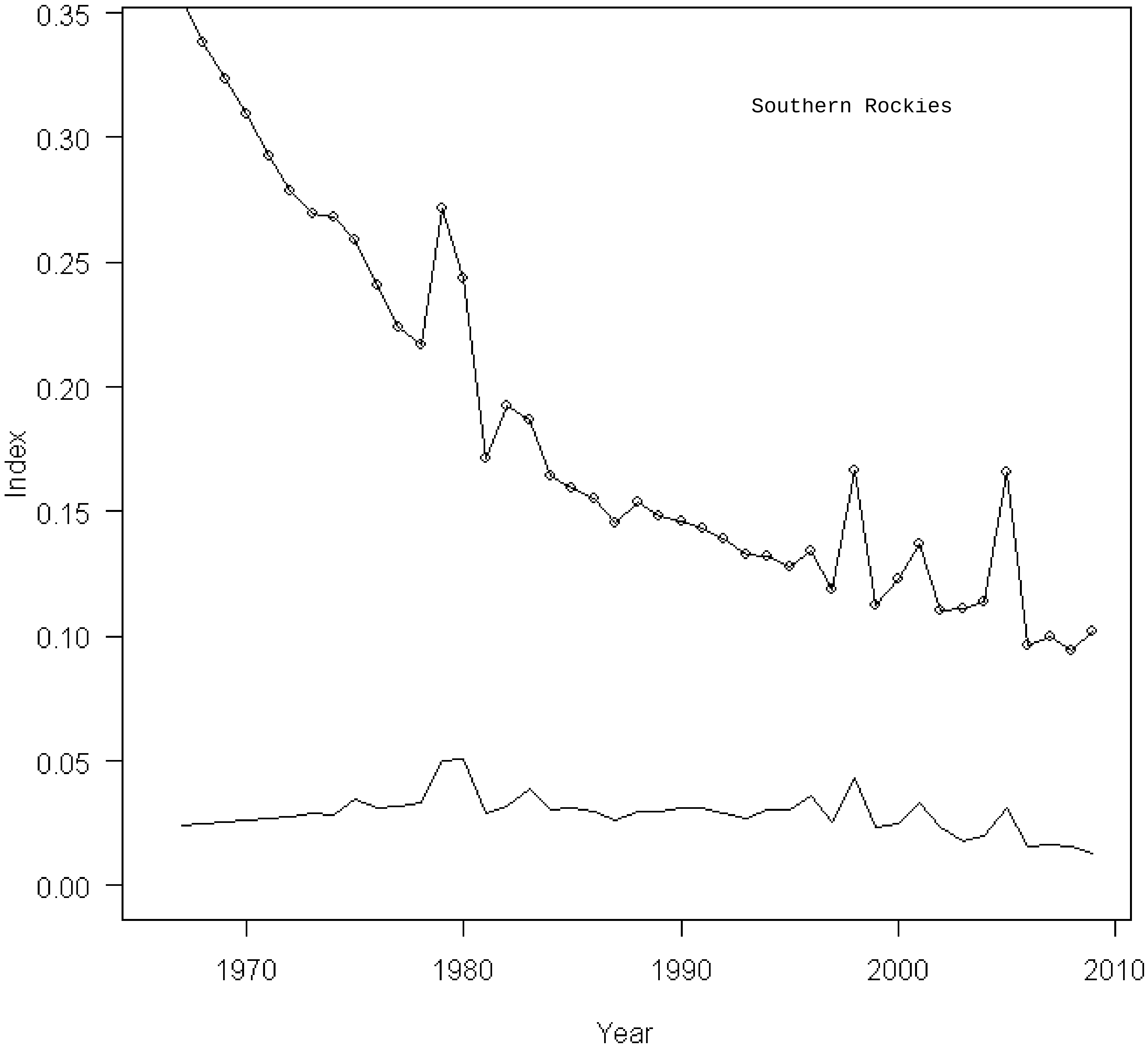


Population Change Map

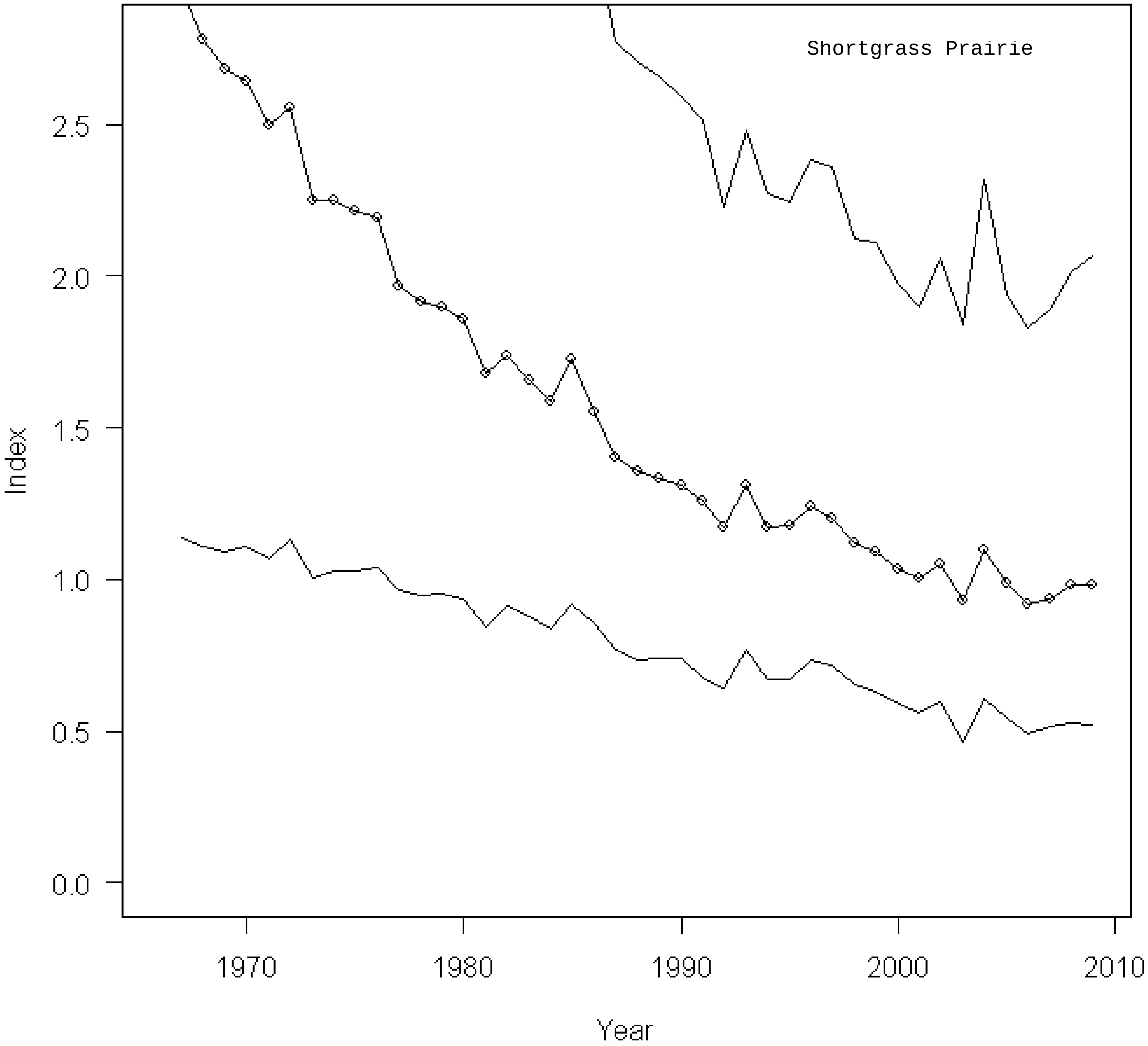


Mountain Plover *Charadrius montanus*										
Region				**1966 - 2009 Trend**		**2000-2009 Trend**				
Name	**N**	**D**	**V**	**%/Yr**	**2.5% - 97.5%**	**%/Yr**	**2.5% - 97.5%**	**%**	**C**	
Northrn Rockies	21		V	-1.2	(-5.7, 3.3)	-2.3	(-13.9, 4.5)	0		
S Rockies CO Pl	10		V	-2.9	(-12.7, 7.7)	-1.3	(-18.0, 36.8)	0		
Shortgrass Pra	45			-2.5	(-5.4, 0.1)	-1.2	(-5.7, 5.0)	0		
Colorado	36		V	-0.9	(-7.0, 3.5)	0.3	(-5.5, 14.7)	0		
New Mexico	10		V	-5.0	(-8.6, -1.2)	-4.8	(-12.1, 2.7)	0		
Wyoming	25		V	-1.2	(-5.7, 3.3)	-2.3	(-13.9, 4.5)	0		
Survey-wide	80		V	-2.6	(-6.7, 0.6)	-1.1	(-5.8, 9.6)	0		

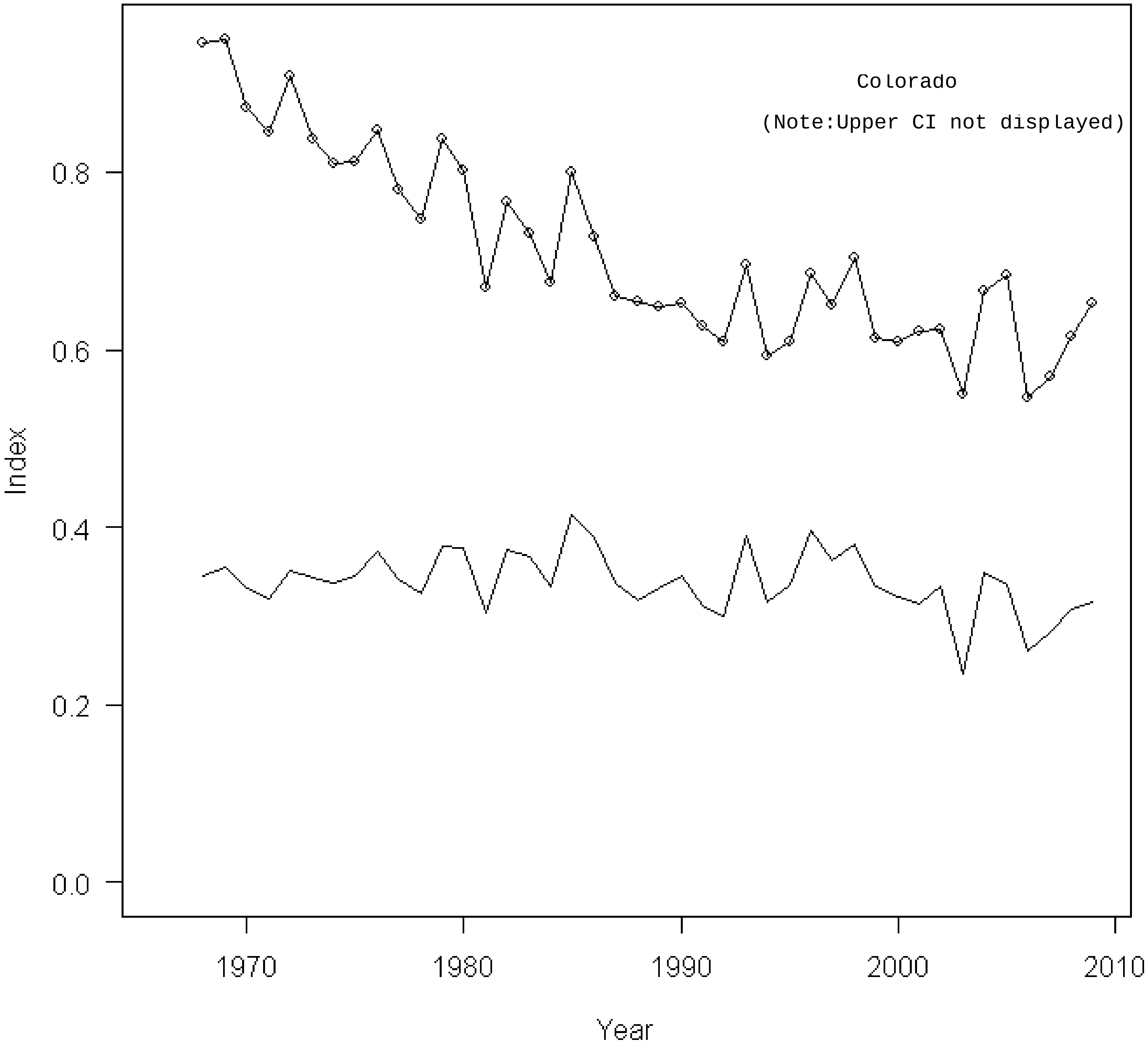

Northern Rockies
Index
Year
1.5
1.0
0.5
0.0
1970
1980
1990
2000
2010

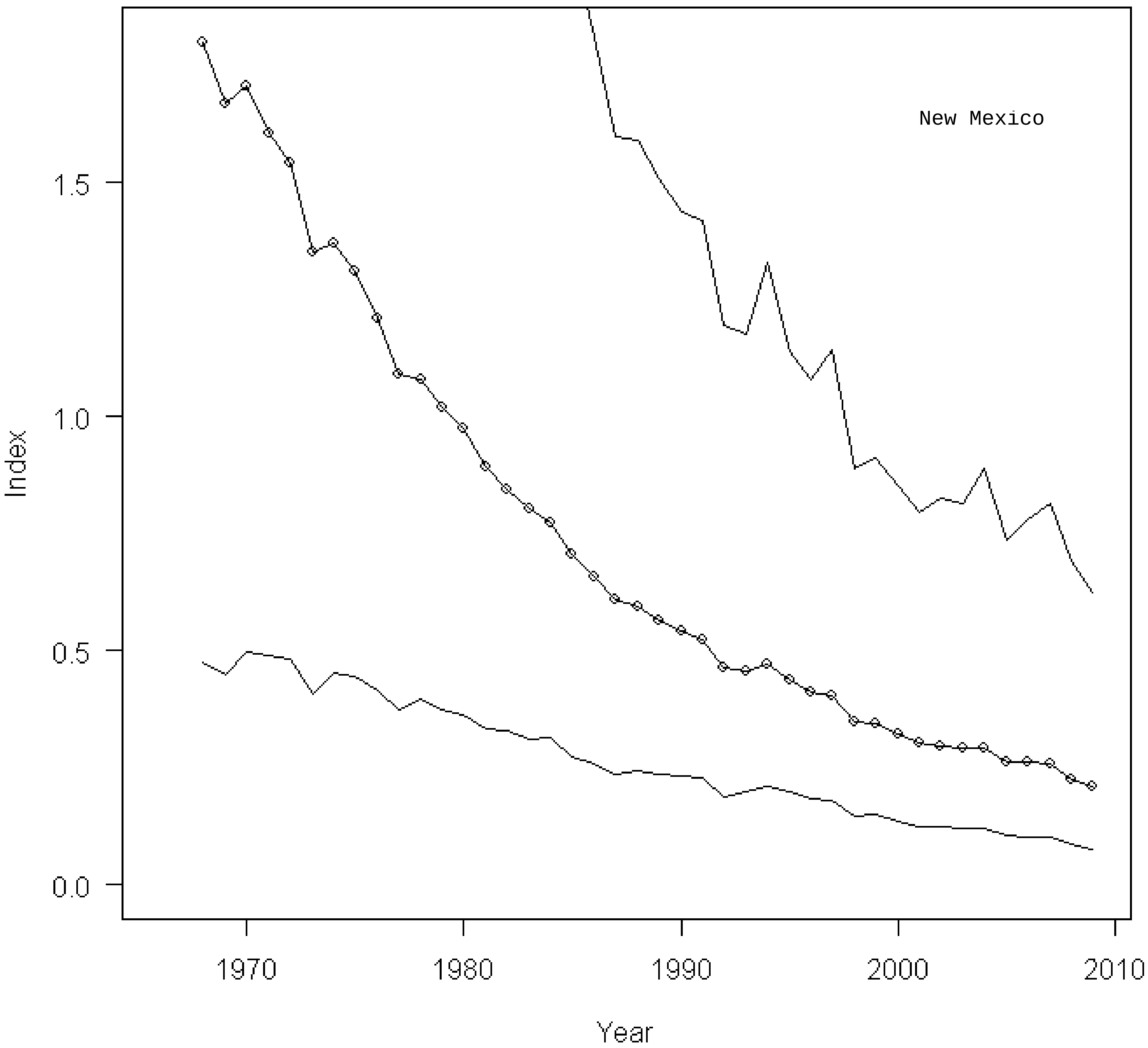


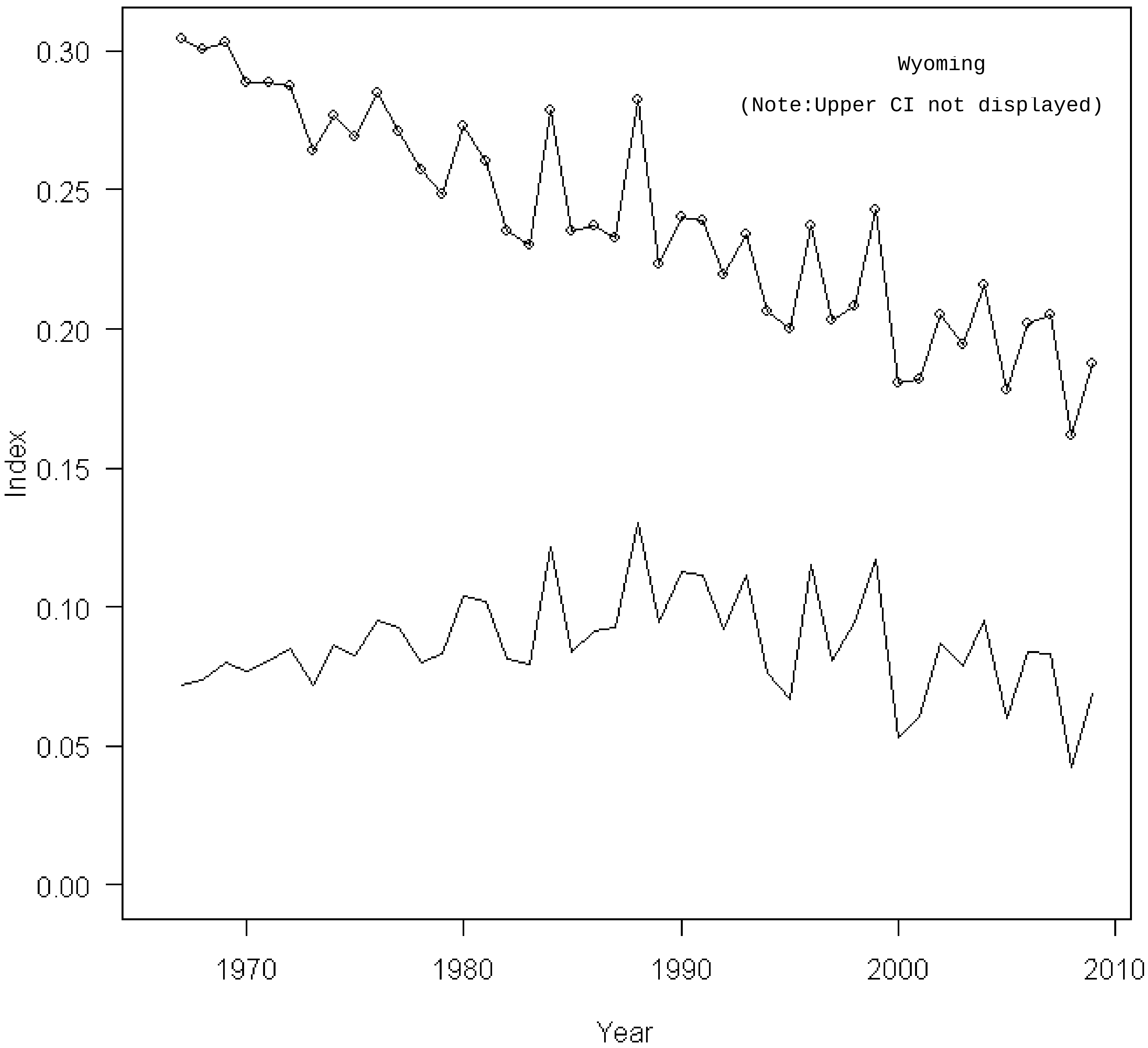
Southern Rockies
Index
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970
1980
1990
2000
2010
Year



Shortgrass Prairie
2.5
2.0
1.5
1.0
0.5
0.0
Index
1970
1980
1990
2000
2010
Year


Colorado
(Note:Upper CI not displayed)
Index
0.0
0.2
0.4
0.6
0.8
1970
1980
1990
2000
2010
Year


New Mexico
Index
Year
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010


Wyoming
(Note:Upper CI not displayed)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Index
1970
1980
1990
2000
2010
Year