THE 2002 ANNUAL REPORT OF THE MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM AT THE NATURE RESERVE OF ORANGE COUNTY

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EXECUTIVE SUMMARY

Since 1989, The Institute for Bird Populations has been coordinating the Monitoring Avian Productivity and Survivorship (MAPS) Program, a cooperative effort among public and private agencies and individual bird banders in North America, to operate a continent-wide network of constant-effort mist-netting and banding stations. The purpose of the MAPS program is to provide annual indices of adult population size and post-fledging productivity, as well as estimates of adult survivorship and recruitment into the adult population, for various landbird species. Broad-scale data on productivity and survivorship are not obtained from any other avian monitoring program in North America and are needed to provide crucial information upon which to initiate research and management actions to reverse the recently-documented declines in North American landbird populations. A second objective of the MAPS program is to provide standardized population and demographic data for the landbirds found on federally managed public lands, such as national parks, national forests, military installations, and nature reserves.

We operated ten MAPS stations on The Nature Reserve of Orange County (NROC) in 2002, at the same locations at which they were operated in 2001. Two of the stations were first operated in 1998, two in 1999, two in 2000, and four were first operated in 2001. With few exceptions, the ten net sites per station were operated in 2002 for six morning hours per day on one day per 10-day period for ten consecutive 10-day periods between May 3 and August 3. A total of 1630 birds of 53 species were banded at the ten stations during the summer of 2002, various individuals were recaptured a total of 613 times, and 519 birds were captured and released unbanded. Thus, a total of 2762 captures of 62 species was recorded.

Overshadowing all other results in 2002 was documentation of a nearly complete reproductive failure at the NROC MAPS stations, the likes of which have not been recorded within the MAPS program since its inception in 1989. No young were captured at any of the ten NROC MAPS stations for 29 of 39 species for which at least one adult was captured. Furthermore, only 54 young birds were captured at all stations combined in 2002 (compared to 983 in 2001), and 25 of these 54 were young House Finches. Mean productivity for all stations combined was just 0.04, the lowest ever recorded at a MAPS location, and ranged from 0.00 at Irvine Park to 0.09 at Upper Weir Canyon. Thus, this reproductive failure was both region wide and species wide.

Examination of weather data indicates that the extremely dry conditions experienced in Southern California during the winter and early spring were likely related to this reproductive failure. Only 0.93 inches of rain fell at the San Diego Airport during December 2001-February 2002, representing the lowest such 3-month total in the past 100 years. Such extremely dry conditions prohibit growth of vegetative matter and result in a paucity of insect and other vegetative and invertebrate prey resources that landbirds need to feed their young. Adults were also likely to have been in poor reproductive condition due to the lack of food. In Dec-Feb 2002-2003, 6.87 inches of rain fell, which should result in better productivity during the breeding season of 2003.

According to multivariate analyses including terms for year, geographic location, landscape, and station, there was little variation in numbers of adults captured by year, although for Bushtit and Wrentit adults captured in 2002 were significantly higher than those captured in 2000. Numbers of adults captured also did not vary greatly by geographic location, except for expected differences; e.g., inland species such as Bewick's Wren, House Wren, Rufous-crowned Sparrow showed higher breeding populations in the central reserve and coastal species such as Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, and Song Sparrow showed higher breeding populations in the coastal reserve. There was also only slight variation in adults captured according to landscape (core, road-edge, and housing development stations), and differences among stations were also generally slight, and largely reflected differences in geographic location and/or landscape.

Logistic regression analyses confirmed the highly significant lack of productivity recorded in 2002. Given this, it is not surprising that variation in productivity by geographic location, landscape, and station were similar to that reported last year using two years of data. Productivity was near-significantly higher in the central reserve than in the coastal reserve for all species pooled, and productivity was significantly greater at housing-development stations than at core stations.

Adult population sizes have generally declined during 1999-2002 at NROC. Population trends for 11 of 14 species showed declines. For nine species and all species pooled, population trends showed substantial decreases, with those of Spotted Towhee, Orange-crowned Warbler, and Song Sparrow showing significant or near-significant declines. By contrast, only three species showed increases, and these were all non-substantial. Populations generally drop after years of poor productivity so it is likely that these declines will become more widespread and severe with the inclusion of 2003 data. Four-year productivity trends generally showed erratic fluctuations, but no substantial trend. Many species showed lower productivity in 1999, higher productivity in 2000 and 2001, and extremely low productivity in 2002, thus showing overall declines.

Between-year changes in adult breeding populations and productivity generally followed the opposite pattern during 1999-2002 at NROC, culminating in significant increase in breeding populations in 2002 but a highly significant decrease in productivity. This alternating population dynamic has been noted at other MAPS stations, and we believe it relates to density-dependent effects on productivity and recruitment along with lower productivity of first-time breeders. Of concern is that this pattern has also been superimposed upon a general decline in populations, which will very likely become more widespread and severe in 2003 based on the reproductive failure of 2002. Disruptions of this alternating cycle at other MAPS stations have generally appeared to be related to unusually favorable or unfavorable weather or to pronounced changes in the environment. In this respect we might expect the severe drought conditions of the winter of 2001-2002 at NROC to disrupt this cycle, although the resultant poor productivity occurred during a year (2002) when low productivity was already expected based on higher breeding populations. Based on both rainfall totals and the above-described population dynamic, we can now predict better productivity in 2003, which will hopefully cause breeding populations eventually to rebound at NROC.

With four years of data, survival estimates were obtained for eight species using modified (CJS) mark-recapture models. We expect to be able to estimate adult survival rates for as many as 14 target species at NROC once more years of data from all ten stations are available. Time-dependence in estimates of survivorship, recapture probability, and/or proportion of residents will also be available when at least five years of data have accumulated from six or more stations.

Results of the first four-five years of the MAPS Program at the NROC indicate that important information on the annual indices and estimates, between-year changes, and temporal trends in adult population size, productivity, and survivorship can be obtained for at least 14 key target species at NROC. In addition, MAPS data from NROC will provide an invaluable contribution to the determination of precise indices of adult population size and productivity and estimates of survivorship on a region-wide basis for landbirds of Southern California and for all of North America. As more years of MAPS data accumulate at NROC we are confident that we will be able to measure and assess the effects of productivity and survivorship as driving forces of population trends at NROC. As a result, the indices and estimates of primary demographic parameters produced by MAPS will be extremely useful for the management and conservation of landbirds at NROC and, in combination with similar data from other areas, across all of North America. We conclude that the MAPS protocol is extremely well-suited as a component of NROC's long-term ecological monitoring program.

Finally, we have initiated three additional types of broad-scale analyses on longer time series of MAPS data from other locations to help us further understand the population dynamics of landbirds. First, by modeling spatial variation in vital rates as a function of spatial variation in population trends we have been able to identify the proximate demographic causes of population decline for various species at multiple spatial scales. Second, we have found that patterns of landscape structure detected within a two- to four-kilometer radius area of each station are good predictors not only of the numbers of birds of each species captured but, more importantly, their productivity levels as well. Based on these analyses, threshold values of critical habitat characteristics, such as habitat patch size, can be determined that will maximize productivity, thereby providing an extremely powerful tool to aid in formulating management actions aimed at reversing landbird population declines. Third, we have successfully correlated broad-scale climatic patterns to productivity values in several regions of North America. We plan to conduct analogous analyses on data from the NROC when eight or more years of data have accumulated from all ten stations; in light of the 2003 reproductive failure it will be especially interesting to correlate winter rainfall totals to productivity at NROC.

Based on all the above information, it is recommended that the MAPS Program continue to be included as an integral part of NROC's long-term ecological monitoring program, and that operation of the ten currently active stations be sustained indefinitely into the future.

INTRODUCTION

The Nature Reserve of Orange County (NROC) is an extensive open space network consisting of relatively intact, coastal sage scrub plant communities. Due to the presence of federally-listed threatened species in this planning area, a Natural Community Conservation Plan (NCCP) and Habitat Conservation Plan have been developed to address Section 10 of the Endangered Species Act. The need for these plans was made apparent by a combination of cumulative impacts on coastal sage scrub resources and the legislative and regulatory responses to those impacts. The federal listing of the Coastal California Gnatcatcher and the potential listing of several additional species that depend upon coastal sage scrub habitat generated a need for a shift from single-species management and project-by-project decisions to conservation planning at the natural community level (Hamilton 2003, Hamilton and Messer 2003). The coastal sage scrub NCCP program was developed to address this need, with the goal of designating regional reserves to protect a wide range of species while allowing compatible land uses to occur within the reserves and appropriate growth and economic development outside the reserves.

The NROC Technical Advisory Committee is presently developing a comprehensive monitoring program to document baseline conditions within the Reserve during the initial years of the NCCP program, and to monitor population trends and ecological functions within the Reserve. It is anticipated that these monitoring results will be used to help guide NROC adaptive management activities, and to demonstrate the extent to which the NCCP program is successful in conserving coastal sage scrub habitat values for a variety of native plant and wildlife species, including a number of declining bird species.

The development of an effective long-term monitoring program at NROC can be of even wider importance than aiding in the managing of those resources. Studies conducted at NROC, when combined with those on other preserved and non-preserved areas, can provide invaluable information for monitoring natural ecological processes and for evaluating the effects of large-scale, even global, environmental changes. Thus, long-term monitoring data can provide information that is crucial for efforts to preserve natural resources and biodiversity on a continental or even global scale.

Landbirds

Landbirds, because of their high body temperature, rapid metabolism, and high trophic position on most food webs, may be excellent indicators of the effects of local, regional, and global environmental change in terrestrial ecosystems. Furthermore, their abundance and diversity in virtually all terrestrial habitats, diurnal nature, discrete reproductive seasonality, and intermediate longevity facilitate the monitoring of their population and demographic parameters. It is not surprising, therefore, that landbirds have been selected by many agencies to receive high priority for monitoring. Nor is it surprising that several large-scale monitoring programs that provide annual population estimates and long-term population trends for landbirds are already in place on this continent. They include the North American Breeding Bird Survey (BBS), the Breeding Bird Census, the Winter Bird Population Study, and the Christmas Bird Count.

Recent analyses of data from several of these programs, particularly the BBS, suggest that populations of many landbirds, including forest, scrubland, and grassland species, appear to be in serious decline (Peterjohn et al. 1995). Indeed, populations of most landbird species appear to be declining on a global basis. Nearctic-Neotropical migratory landbirds (those that breed in North America and winter in Central and South America and the West Indies; hereafter, Neotropical migratory birds) constitute one group for which pronounced population declines have been documented (Robbins et al. 1989, Terborgh 1989). In response to these declines, the Neotropical Migratory Bird Conservation Program, "Partners in Flight - Aves de las Americas," was initiated in 1991 (Finch and Stangel 1993). The major goal of Partners in Flight (PIF) is to reverse the declines in Neotropical migratory birds through a coordinated program of monitoring, research, management, education, and international cooperation. Recent analyses have also indicated that many resident North American species are also declining; thus, monitoring of all North American landbirds is needed, including both resident and migrant species.

Primary Demographic Parameters

Existing population-trend data on landbirds, while suggesting severe and sometimes accelerating declines, provide no information on primary demographic parameters (productivity and survivorship) of these birds. Thus, population-trend data alone provide no means for determining at what point(s) in the life cycles problems are occurring, or to what extent the observed population trends are being driven by causal factors that affect birth rates, death rates, or both (DeSante 1995). For example, large-scale North American avian monitoring programs that provide only population-trend data have been unable to determine to what extent forest fragmentation and deforestation on the temperate breeding grounds, versus that on the tropical wintering grounds, are causes for declining populations of Neotropical migrants. Without critical data on productivity and survivorship, it will be extremely difficult to identify effective management and conservation actions to reverse current population declines (DeSante 1992).

The ability to monitor primary demographic parameters of target species must also be an important component of any successful long-term inventory and monitoring program that aims to monitor the ecological processes leading from environmental stressors to population responses (DeSante and Rosenberg 1998). This is because environmental factors and management actions affect primary demographic parameters directly and these effects can be observed over a short time period (Temple and Wiens 1989). Because of the buffering effects of floater individuals and density-dependent responses of populations, there may be substantial timelags between changes in primary parameters and resulting changes in population size or density as measured by census or survey methods (DeSante and George 1994). Thus, a population could be in trouble long before this becomes evident from survey data. Moreover, because of the vagility of many animal species, especially birds, local variations in secondary parameters (e.g., population size or density) may be masked by recruitment from a wider region (George et al. 1992) or accentuated by lack of recruitment from a wider area (DeSante 1990). A successful monitoring program should be able to account for these factors.

MAPS

In 1989, The Institute for Bird Populations (IBP) established the Monitoring Avian Productivity

and Survivorship (MAPS) program, a cooperative effort among public agencies, private organizations, and individual bird banders in North America to operate a continent-wide network of constant-effort mist-netting and banding stations to provide long-term demographic data on landbirds (DeSante et al. 1995). The design of the MAPS program was patterned after the very successful British Constant Effort Sites (CES) Scheme that has been operated by the British Trust for Ornithology since 1981 (Peach et al. 1996). The MAPS program was endorsed in 1991 by both the Monitoring Working Group of PIF and the USDI Bird Banding Laboratory, and a four-year pilot project (1992-1995) was approved by the USDI Fish and Wildlife Service and National Biological Service (now the Biological Resources Division [BRD] of the U.S. Geological Survey [USGS]) to evaluate its utility for monitoring demographic parameters of landbirds. A peer review of the MAPS program and evaluation of the pilot project were completed by a panel assembled by USGS/BRD, which concluded that: (1) MAPS is technically sound and is based on the best available biological and statistical methods; (2) it complements other landbird monitoring programs such as the BBS by providing useful information on landbird demographics that is not available elsewhere; and (3) it is the most important project in the nongame bird monitoring arena since the creation of the BBS (Geissler 1996).

Now in its fourteenth year (eleventh year of standardized protocol and extensive distribution of stations), the MAPS program has expanded greatly from 178 stations in 1992 to over 500 stations in 2002. The substantial growth of the Program since 1992 was caused by its endorsement by PIF and the subsequent involvement of various federal agencies, including the Department of Defense, Department of the Navy, Texas Army National Guard, National Park Service, USDA Forest Service, and US Fish and Wildlife Service, and private organizations in PIF. Within the past ten years, for example, IBP has been contracted to operate over 150 MAPS stations on federal lands, including stations on seven national forest, five national parks, and 21 military installations, as well as three stations on the Flathead Indian Reservation of the Confederated Salish and Kootenai Tribes and ten stations on the Nature Reserve of Orange County. Furthermore, many private organizations and individual bird banders and ornithologists interested in monitoring the vital rates of avian populations on federal, state, local government, and private lands, such as Audubon sanctuaries and nature preserves, have established and operated about 350 additional MAPS stations.

Goals and Objectives of MAPS

MAPS is organized to fulfill three tiers of goals and objectives: monitoring, research, and management.

- The specific monitoring goals of MAPS are to provide, for over 100 target species, including many Neotropical-wintering migrants, temperate-wintering migrants, and permanent residents:

  (A) annual indices of adult population size and post-fledging productivity from data on the numbers and proportions of young and adult birds captured; and
  (B) annual estimates of adult population size, adult survival rates, proportions of residents, recruitment rates into the adult population, and population growth rates from modified

Cormack- Jolly-Seber analyses of mark-recapture data on adult birds.

- The specific research goals of MAPS are to identify and describe:

  (1) temporal and spatial patterns in these demographic indices and estimates at a variety of spatial scales ranging from the local landscape to the entire continent; and
  (2) relationships between these patterns and ecological characteristics of the target species, population trends of the target species, station-specific and landscape-level habitat characteristics, and spatially-explicit weather variables.

- The specific management goals of MAPS are to use these patterns and relationships, at the appropriate spatial scales, to:

  (a) identify thresholds and trigger points to notify appropriate agencies and organizations of the need for further research and/or management actions;
  (b) determine the proximate demographic cause(s) of population change;
  (c) suggest management actions and conservation strategies to reverse population declines and maintain stable or increasing populations; and
  (d) evaluate the effectiveness of the management actions and conservation strategies actually implemented through an adaptive management framework.

The overall objectives of MAPS are to achieve the above-outlined goals by means of long-term monitoring at two major spatial scales. The first is a very large scale — effectively the entire North American continent divided into eight geographical regions. It is envisioned that large nature preserves, along with national forests, national parks, DoD military installations, and other publicly owned lands and tribal reservations can provide a major subset of sites for this large-scale objective.

The second, smaller-scale but still long-term goal is to fulfill the above-outlined objectives for specific geographical areas (perhaps based on physiographic strata or Bird Conservation Regions) or specific locations (such as individual nature reserves, national forests, national parks, or military installations) to aid research and management efforts within the reserves, forests, parks, or installations to protect and enhance their avifauna and ecological integrity. The sampling strategy utilized at these smaller scales should be hypothesis-driven and should be integrated with other research and monitoring efforts.

Both long-term goals are in agreement with the NROC's integrated bird monitoring program as established by the NROC Technical Advisory Committee. Accordingly, a preliminary MAPS program was established at NROC in 1998, which was expanded in 1999 and 2000, and again in 2001. It is expected that the MAPS program will be capable of providing integrated data on avian population trends and vital rates, as well as information on the causes of population declines and potential management actions that can be undertaken to reverse the declines. This is some of the basic information that is required to drive the NROC's "adaptive management" program with the overall long-term goal of conserving avian biodiversity within the NROC.

SPECIFICS OF THE NROC MAPS PROGRAM

The NROC's coastal subregional reserve consists of 17,201 acres located primarily in and surrounding the San Joaquin Hills, Orange County, California. It extends from the shoreline of Crystal Cove State Park northeast almost 7.5 miles inland, and from Upper Newport Bay southeast approximately 16 miles to the confluence of Oso and Trabuco creeks. The NROC's central subregional reserve comprises approximately 20,177 acres located south and west of the Cleveland National Forest in the foothills and southwestern slopes of the Santa Ana Mountains. From its western boundary at Santiago Oaks Regional Park in the City of Orange, the subarea extends east about 14 miles to El Toro Road. From its northernmost point in the Coal Canyon Preserve, it continues about 7.5 miles southwest to the southern edge of the Lomas de Santiago.

Ten MAPS stations were re-established and operated in NROC in 2002, all in exactly the same locations as they were operated during previous years. Two stations (Little Sycamore Canyon and Weir Canyon) have been operated for five years (1998-2002). Four more stations were established in 1999, but due to a shortage of volunteers only two of them (Irvine Park and Upper Laurel Canyon) underwent full operation that year. Six stations were run in 2000, including two stations (Upper Wood Canyon and Upper Weir Canyon) that operated for their first full year. Finally, four new stations (Emerald Canyon, Round Canyon, Sycamore Hills, and Whiting Ranch) were established and first operated in 2001. Overall, five stations (Little Sycamore Canyon, Emerald Canyon, Upper Laurel Canyon, Upper Wood Canyon, and Sycamore Hills) are located in the NROC's coastal reserve and five stations (Weir Canyon, Round Canyon, Irvine Park, Upper Weir Canyon, and Whiting Ranch) are located in NROC's central reserve. Within each reserve, two stations are designated as the core stations (Little Sycamore Canyon and Emerald Canyon in the coastal reserve, and Weir Canyon and Round Canyon in the central reserve) and are located within central portions of the reserves; one station is designated as the "road-edge" station (Upper Laurel Canyon in the coastal reserve, and Irvine Park in the central reserve) and is located within 300 m of major transportation corridors; and two stations are designated as the housing stations (Upper Wood Canyon and Sycamore Hills in the coastal reserve, and Upper Weir Canyon and Whiting Ranch in the central reserve) and are located within 300 m of suburbs with houses. All ten stations were established in relatively mature, coastal sage scrub habitat; six of the stations contained scattered large shrubs and coast live oaks, whereas three of the four housing stations (Upper Wood Canyon, Upper Weir Canyon, and Sycamore Hills) and one of the core stations (Emerald Canyon) were in pure scrub or scrub/grassland, lacking oak woodland. A summary of the major habitats represented at each of the ten stations, along with the geographic location (coastal preserve, central preserve), local landscape type (core, road-edge, housing-development), latitude-longitude, and average elevation of the station, is presented in Table 1.

In 2002, the NROC stations were operated by IBP field biologist interns, who were assisted by a number of trained volunteers. The 2002 NROC field biologist interns, Gabriel Cahalan, Matthieu Coles, Daniel Farrar, and Shannon Page, received 10 days of intensive training in a comprehensive course in mist netting and bird-banding techniques given by IBP biologist Pilar Velez, with assistance from Starr Ranch Sanctuary biologist Dana Kamada, which took place

April 21-30 at Starr Ranch, Trabuco Canyon, Orange County. Pilar and the interns began to re-establish the ten stations on May 1, data collection began at the first station on May 3, and all ten stations were established by May 8. Pilar Velez then supervised the 2002 interns for the duration of the field work at the NROC.

All ten net sites at each of the ten stations were re-established without excessive difficulty at the exact same locations as in 2001. All of the ten fixed net sites at each station were located within the interior eight ha of each station. On each day of operation, one 12-m long, 30-mm mesh, 4-tier, nylon mist net was erected at each of the ten net sites. These ten nets at each station were operated for six morning hours per day (beginning at local sunrise) on one day during each of ten consecutive 10-day periods between Period 1 (May 1-10) and Period 10 (July 30-August 8). The operation of all stations occurred on schedule in each of the ten 10-day periods. A summary of the operation of the 2002 NROC MAPS Program at each of the ten stations, along with the number of years of operation at each station, is presented in Table 1.

METHODS

The operation of each of the ten stations during 2002 and during each of the preceding years followed MAPS protocol, as established for use by the MAPS Program throughout North America and detailed in the MAPS Manual (DeSante et al. 2002). An overview of both the field and analytical techniques is presented here.

Data Collection

With few exceptions, all birds captured during the course of the study were identified to species, age, and sex and, if unbanded, were banded with USGS/BRD numbered aluminum bands. Birds were released immediately upon capture and before being banded or processed if situations arose where bird safety would be comprised. Such situations involved exceptionally large numbers of birds being captured at once, or the sudden onset of adverse weather conditions such as high winds or sudden rainfall. The following data were taken on all birds captured, including recaptures, according to MAPS guidelines using standardized codes and forms:

(1) capture code (newly banded, recaptured, band changed, unbanded);
(2) band number;
(3) species;
(4) age and how aged;
(5) sex (if possible) and how sexed (if applicable);
(6) extent of skull pneumaticization;
(7) breeding condition of adults (i.e., presence or absence of a cloacal protuberance or brood patch);
(8) extent of juvenal plumage in young birds;
(9) extent of body and flight-feather molt;
(10) extent of primary-feather wear;
(11) fat class;
(12) wing chord and weight;
(13) date and time of capture (net-run time); and
(14) station and net site where captured.

Effort data, i.e., the number and timing of net-hours on each day (period) of operation, were also collected in a standardized manner. In order to allow constant-effort comparisons of data to be made, the times of opening and closing the array of mist nets and of beginning each net check were recorded to the nearest ten minutes. The breeding (summer residency) status (confirmed breeder, likely breeder, non-breeder) of each species seen, heard, or captured at each MAPS station on each day of operation was recorded using techniques similar to those employed for breeding bird atlas projects.

For each of the ten stations operated, simple habitat maps were prepared on which up to four major habitat types, as well as the locations of all structures, roads, trails, and streams, were identified and delineated; when suitable maps from previous years were available, these were used. The pattern and extent of cover of each major habitat type identified at each station, as

well as the pattern and extent of cover of each of four major vertical layers of vegetation (upperstory, midstory, understory, and ground cover) in each major habitat type were classified into one of twelve pattern types and eleven cover categories according to guidelines spelled out in the MAPS Habitat Structure Assessment Protocol, developed by IBP Landscape Ecologist, M. Philip Nott and the IBP staff (Nott et al. 2002a).

Computer Data Entry and Verification

The computer entry of all banding data was completed by John W. Shipman of Zoological Data Processing, Socorro, NM. The critical data for each banding record (capture code, band number, species, age, sex, date, capture time, station, and net number) were proofed by hand against the raw data and any computer-entry errors were corrected. Computer entry of effort and vegetation data was completed by IBP biologists using specially designed data entry programs. All banding data were then run through a series of verification programs as follows:

(1) Clean-up programs to check the validity of all codes entered and the ranges of all numerical data;
(2) Cross-check programs to compare station, date, and net fields from the banding data with those from the/ summary of mist netting effort data;
(3) Cross-check programs to compare species, age, and sex determinations against degree of skull pneumaticization, breeding condition (extent of cloacal protuberance and brood patch), and extent of body and flight-feather molt, primary-feather wear, and juvenal plumage;
(4) Screening programs which allow identification of unusual or duplicate band numbers or unusual band sizes for each species; and
(5) Verification programs to screen banding and recapture data from all years of operation for inconsistent species, age, or sex determinations for each band number.

Any discrepancies or suspicious data identified by any of these programs were examined manually and corrected if necessary. Wing chord, weight, station of capture, date, and any pertinent notes were used as supplementary information for the correct determination of species, age, and sex in all of these verification processes.

Data Analysis

To facilitate analyses, we first classified the landbird species captured in mist nets into five groups based upon their breeding or summer residency status. Each species was classified as one of the following: a regular breeder (B) if we had positive or probable evidence of breeding or summer residency within the boundaries of the MAPS station *during all years* that the station was operated; a usual breeder (U) if we had positive or probable evidence of breeding or summer residency within the boundaries of the MAPS station *during more than half but not all of the years* that the station was operated; an occasional breeder (O) if we had positive or probable evidence of breeding or summer residency within the boundaries of the MAPS station *during half or fewer of the years* that the station was operated; a transient (T) if the species was *never* a breeder or summer resident at the station, but the station was within the overall breeding range of

the species; and a migrant (M) if the station was not located within the overall breeding range of the species. All data for a given species from a given station were included in year-specific (i.e., 2001 or 2002) or mean population size and productivity analyses for the species (e.g., Tables 3, 4 [in part], and 5-8; Figures 1-11) unless the species was classified as a migrant (M) at the station. For survivorship estimates (Table 9) and population size and productivity trends (Figures 12 and 13), data for a given species from a given station were included only if the species was classified as a regular (B) or usual (U) breeder and summer resident at the station. Thus, data from a station for a species classified as a migrant (M) at the station were included only in year-specific summaries of the total numbers of captures (Tables 2 and 4 [in part]).

A. Population-size and productivity analyses — The proofed, verified, and corrected banding data from 2002 were run through a series of analysis programs that calculated for each species and for all species pooled at each station and for all stations pooled:

(1) the numbers of newly banded birds, recaptured birds, and birds released unbanded;
(2) the numbers and capture rates (per 600 net-hours) of first captures (in 2002) of individual adult and young birds; and
(3) the proportion of young in the catch.

Following the procedures pioneered by the British Trust for Ornithology (BTO) in their CES Scheme (Peach et al. 1996), the number of adult birds captured was used as an index of adult population size, and the proportion of young in the catch was used as an index of post-fledging productivity.

For each of the ten stations, we calculated percent changes between 2001 and 2002 in the numbers of adult and young birds captured, and actual changes in post-fledging productivity. These year-to-year comparisons were made in a "constant-effort" manner by means of a specially designed analysis program that used actual net-run (capture) times and net-opening and -closing times on a net-by-net and period-by- period basis to exclude captures that occurred in a given net in a given period in one year during the time when that net was not operated in that period in the other year. For species captured at several stations on the Nature Reserve of Orange County, we followed the methods developed by the BTO in their CES scheme (Peach et al. 1996) and inferred the statistical significance of reserve-wide changes in the indices of population size and productivity using confidence intervals derived from the standard errors of the mean percentage (or, for productivity, mean actual) changes. The statistical significance of the overall change at a given station was inferred from a one-sided binomial test on the proportion of species at that station that increased (or decreased). Throughout this report, we use an alpha level of 0.05 for statistical significance. For year-to-year comparisons, however, we use the term “near-significant” or “nearly significant” for differences for which $0.05 \leq P < 0.10$.

For each of the six stations operated for the three years, 2000-2002, and for all stations combined, we calculated three-year means for the numbers of adult and young birds captured per 600 net hours and the proportion of young in the catch for each individual species and for all

species pooled. While these mean numbers provide an indication of the relative adult population size and productivity of the various species at each station and at all stations pooled they don't provide sufficient information by them selves for statistical inference of the differences in adult population size or productivity among years, geographic locations (coastal vs central reserves), local landscape type, or station. In order to make such inferences, we conducted multivariate analyses of variance (of numbers of adults captured) and logistic regression analyses (of productivity).

B. Multivariate analyses adult population size — We conducted multivariate ANOVAs of indices of adult population size (mean number of adult birds captured) as a function or year and various spatial variables, including geographic location, local landscape, and station. We used data for these multivariate ANOVAs from the six stations that were each operated for the three years, 2000-2002. Because year, geographic location, local landscape, and station are incorporated into the ANOVAs as non-continuous variables, the analysis format requires the designation of a reference station or reference group against which the relative mean number of adults for the other stations or groups are compared. We chose 2000 as the reference year (so that the results of these ANOVAs of indices of adult population size could be compared to the results of logistic regression analyses of productivity, see below), coastal reserve as the reference geographic location, and core as the reference local landscape (because it had not been disturbed). Little Sycamore Canyon, the core coastal station, was chosen as the reference station. We set the relative number of adults to be zero for each of the reference states, that is, for the reference year, reference geographic location, reference local landscape, and reference station.

We first conducted multivariate ANOVAs for indices of adult population size on the variables year, geographic location, and local landscape to see if significant differences in numbers of adult birds captured occurred among years, between geographic locations (coastal vs. central reserves), or among local landscape types when controlling for each of the other variables. Because each station has a unique combination of geographic location and local landscape, we could not also include the variable station in these multivariate ANOVAs. Rather, we then conducted multivariate ANOVAs for indices of adult population size on the variables year and station (i.e., without controlling for geographic location or local landscape) to see if significant differences occurred among stations when controlling for year.

Data preparation for the ANOVA analyses was completed using data-management programs in dBASE4. The multivariate ANOVAs themselves were completed using the statistical-analysis package STATA (Stata Corporation 1995), and statistical significance was determined based on the F-statistic. We conducted these multivariate ANOVAS for all species pooled, for each of the 14 target species (see under section "D" for determination criteria), and for House Finch, which did not meet the four-year target species criteria.

C. Logistic regression analyses of productivity — The use of logistic regression provides an analytical framework for examining productivity in a multivariate manner as a function of year (in multi-year data sets) and various spatial variables, including geographic location, local

landscape, and station. Logistic regression, when used in productivity analyses, estimates the probability of an individual bird captured at random being a young bird. The "odds ratio", the term used for the probability value produced by logistic regression, is the odds of a captured individual being a young bird after the variables incorporated into the model (e.g., year, geographic location, local landscape) have been accounted for. Assume, for example, that we are using a logistic regression model for productivity that incorporates the variables year, geographic location, and local landscape, and we have data from two geographic locations. If the odds ratio for the data from one geographic location was 1.2, then the probability of a captured bird being a young bird at that location was 1.2 times as great as the probability of being a young bird at the other location. In other words, one can infer that productivity at the first location is 1.2 times as great as the productivity at the second location. Any number of variables can be incorporated into the logistic regression analyses, but here we concentrate on how productivity was affected by year, geographic location, local landscape, and station. We used data in these logistic regression analyses from the six stations that were each operated for the three years, 2000-2002.

Because year, geographic location, local landscape, and station are each incorporated into the logistic regression model as non-continuous variables, the analysis format requires the designation of a reference year, reference station, and reference group against which the odds ratios for the other years, stations, or groups are compared. We chose 2000 as the reference year (productivity was too low in 2002 to serve as the reference year), coastal reserve as the reference geographic location, and core as the reference local landscape (as it has not been disturbed). Little Sycamore Canyon, the core coastal station, was chosen as the reference station.

In addition to providing multivariate logistic regression analyses for all species pooled, we attempted these analyses for each species for which we conducted multivariate ANOVAS of adult population size, that is, each of the 14 target species (as defined in Section D, below), as well as House Finch, which didn't meet target species criteria. Additionally, data was only included from station-years that met the requirements for productivity analyses (i.e., the station was operated for a minimum of 5 periods, with 3 periods operated in the adult super-period and 2 periods operated in the young super-period). The 15 species for which we attempted ANOVAS (on indices of adult population size) and logistic regression analyses (on productivity) were "Western" Flycatcher, Ash-throated Flycatcher, Bushtit, Bewick's Wren, House Wren, Wrentit, California Thrasher, Common Yellowthroat, Spotted Towhee, California Towhee, Rufous-crowned Sparrow, Song Sparrow, House Finch, and Lesser Goldfinch.

Data preparation for the logistic regression analyses was completed using data-management programs in dBASE4. The logistic regression analyses themselves were completed using the statistical-analysis package STATA (Stata Corporation 1995). For all species pooled and for each of the thirteen individual species, we first ran multivariate logistic regression analyses for productivity on the variables year, geographic location, and local landscape. Because each station has a unique combination of geographic location and local landscape, we could not also include the variable station in these multivariate logistic regression analyses. Rather, for all species pooled and for each of the individual species, we then ran multivariate logistic regression

analyses for productivity on the variables year and station (i.e., without controlling for geographic location or local landscape) to see if significant differences occurred among stations when controlling for year. Statistical significance in all these multivariate models was determined based on the z-statistic (or Wald Statistic) which equates to the maximum likelihood estimate based on the odds ratio divided by the standard error (Stata Corporation 1995).

D. Analyses of trends in adult population size and productivity — We examined four-year (1999-2002) trends in indices of adult population size and productivity for target species for which we recorded an average of seven or more individual adult captures per year at the four stations combined that operated over those four years (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park), and at which the species was a regular (B) or usual (U) breeder. For trends in adult population size, we first calculated adult population indices for each species for each of the four years based on an arbitrary starting index of 1.0 in 1999. Constant-effort changes (as defined above) were used to calculate these "chain" indices in each subsequent year by multiplying the proportional change (percent change divided by 100) between the two years times the index of the previous year and adding that figure to the index of the previous year, or simply:

$$PSI_{i+1} = PSI_i + PSI_i * (d_i/100)$$

where PSI_i is the population size index for year i and d_i is the percentage change in constant-effort numbers from year i to year i+1. A regression analysis was then run to determine the slope of these indices over the four-years (*PT*). Because the indices for adult population size were based on percentage changes, we further calculated the annual percent change (*APC*), defined as the average change per year over the four-year period, to provide an estimate of the population trend for the species; *APC* was calculated as:

(actual 1999 value of *PSI* / predicted 1999 value of *PSI* based on the regression) * *PT*.

We present *APC*, the standard error of the slope (*SE)*, the correlation coefficient (*r)*, and the significance of the correlation (*P*) to describe each trend. Again, we use an alpha level of 0.05 for statistical significance. For purposes of discussion, however, we use the terms "nearly significant" or "near-significant" for trends for which $0.05 \leq P < 0.10$. Species for which $r > 0.5$ are considered to have a substantially increasing trend; those for which $r < -0.5$ are considered to have a substantially decreasing trend; those for which $-0.5 \leq r \leq 0.5$ and $SE \leq 0.219$ (for four-year trends) are considered to have a stable trend; and those for which $-0.5 \leq r \leq 0.5$ and $SE > 0.219$ (for four-year trends) are considered to have widely fluctuating values but no substantial trend.

Trends in Productivity, *PrT*, were calculated in an analogous manner by starting with actual productivity values in 1999 and calculating each successive year's value based on the actual constant-effort changes in productivity between each pair of consecutive years. For trends in productivity, the slope (*PrT*) and its standard error (*SE*) are presented, along with the correlation coefficient (*r)*, and the significance of the correlation (*P*). Productivity trends are characterized

in a manner analogous to that for population trends, except that productivity trends are considered to be highly fluctuating if the SE of the slope > 0.125 (for four-year productivity trends).

E. Survivorship analyses — Modified Cormack-Jolly-Seber (CJS) mark-recapture analyses (Pollock et al.1990, Lebreton et al.1992) were conducted on select target species using four years (1999-2002) of capture histories of adult birds. Target species were those for which, on average, at least seven individual adults per year were recorded from those stations which were operated during each of the four years (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park), and at which the species was a regular (B) or usual (U) breeder. Using the computer program SURVIV (White 1983), we calculated, for each target species, maximum-likelihood estimates and standard errors (*SE*s) for adult survival probability (ϕ), adult recapture probability (p), and the proportion of residents among newly captured adults (τ) using both a between-year and within-year transient model (Pradel et al. 1997, Nott and DeSante 2002). The use of the transient model ($\phi p \tau$) accounts for the existence of transient adults (dispersing and floater individuals which are only captured once) in the sample of newly captured birds, and provides survival estimates that are unbiased with respect to these transient individuals (Pradel et al. 1997). Recapture probability is defined as the conditional probability of recapturing a bird in a subsequent year that was banded in a previous year, given that it survived and returned to the place it was originally banded.

Because we had only four years of data, we used a time-constant transient model for estimating survival and recapture probabilities and the proportion of residents among newly captured adults. We did not consider models that included time-dependence, as four years of data are generally insufficient to provide time-dependent estimates with any reasonable precision. We limited our consideration to models that produced estimates for both survival and recapture probability that were neither 0 nor 1, and to models that fit the data. The goodness of fit of the models was tested by using a Pearson's goodness-of-fit test. We calculated the Akaike Information Criterion ($QAIC_C$, which corrects for over-dispersion of data and is used with smaller sample sizes relative to the number of parameters examined) for each species. The $QAIC_C$ was calculated by multiplying the log-likelihood for the given model by -2, adding two times the number of estimable parameters in the model, and providing corrections for overdispersed data and small sample sizes.

RESULTS

A total of 5718.5 net-hours was accumulated at the ten MAPS stations operated in NROC in 2002 (Table 1). Data from 5503.3 of these net-hours could be compared directly to 2001 data in a constant-effort manner.

Indices of Adult Population Size and Post-fledging Productivity

A. 2002 values — The 2002 capture summary of the numbers of newly-banded, unbanded, and recaptured birds is presented for each species and all species pooled at each of the five coastal reserve stations in Table 2a and for each of the five central reserve stations in Table 2b. The greatest number of total captures (395) was recorded at the Sycamore Hills station (in the coastal reserve), while Irvine Park (in the central reserve) produced the smallest number (138). The highest species richness, 38 species, was recorded at Upper Weir Canyon (in the central reserve), while species richness was lowest at Weir Canyon (also in the central reserve), with 24 species.

The capture rates (per 600 net-hours) of individual adult and young birds and the proportion of young in the catch during 2002 are presented for each species and for all species pooled at each of the coastal reserve (Table 3a) and central reserve (Table 3b) stations. We present capture rates (captures per 600 net-hours) of adults and young in these tables so that the data can be compared among stations which, because of the vagaries of weather and accidental net damage, can differ from one another in effort expended (see Table 1). These capture indices indicate that the total adult population size of all species pooled in 2002 was greatest at Whiting Ranch, followed in descending order by Round Canyon, Upper Weir Canyon, Emerald Canyon, Upper Laurel Canyon, Sycamore Hills, Upper Wood Canyon, Weir Canyon, Irvine Park, and Little Sycamore Canyon. The following is a list of the common breeding species (captured at a rate of at least 6.0 adults per 600 net-hours), in decreasing order, at each station in 2002 (see Table 3):

Coastal Reserve Stations:

Little Sycamore Canyon
Wrentit
Spotted Towhee
"Western" Flycatcher
Common Yellowthroat

Sycamore Hills
Bushtit
Wrentit
"Western" Flycatcher
Spotted Towhee
Orange-crowned Warbler
Yellow Warbler
House Finch

Emerald Canyon
Wrentit
Spotted Towhee
Bushtit
Common Yellowthroat
Song Sparrow
Phainopepla
California Towhee

Upper Wood Canyon
Wrentit
Bushtit
Spotted Towhee
House Finch
Common Yellowthroat

Upper Laurel Canyon
Bushtit
Wrentit
California Towhee
"Western" Flycatcher
Common Yellowthroat
Spotted Towhee
California Thrasher
Orange-crowned Warbler
Song Sparrow

Central Reserve Stations:

Weir Canyon
Wrentit
California Towhee
Spotted Towhee
"Western" Flycatcher
Bewick's Wren

Upper Weir Canyon
Bushtit
Wrentit
Spotted Towhee
"Western" Flycatcher
House Finch
California Towhee
California Thrasher

Round Canyon
Wrentit
Bushtit
Spotted Towhee
"Western" Flycatcher
California Towhee
Bewick's Wren
California Thrasher
Oak Titmouse
House Wren
Orange-crowned Warbler

Irvine Park
Wrentit
Bushtit
Spotted Towhee
California Towhee

Whiting Ranch
Wrentit
Spotted Towhee
Bushtit
Bewick's Wren
California Towhee
House Finch
Song Sparrow
Ash-throated Flycatcher
California Thrasher
"Western" Flycatcher
Cactus Wren

Captures rates of young of all species pooled at each station in 2002 followed a different sequence than that of adults, being highest at Upper Weir Canyon, followed by Whiting Ranch, Upper Wood Canyon, Round Canyon, Emerald Canyon, Sycamore Hills, Little Sycamore Canyon, Weir Canyon, Upper Laurel Canyon, and Irvine Park (with no young captured in 2002). The index of productivity, as determined by the proportion of young in the catch, followed a similar sequence to that of young. Productivity was highest at Upper Weir Canyon (0.09) followed by Whiting Ranch (0.06), Upper Wood Canyon (0.05), Little Sycamore Canyon and Round Canyon (0.03 each), Emerald Canyon and Sycamore Hills (0.02 each), Upper Laurel Canyon and Weir Canyon (0.01 each), and Irvine Park (0.00). These ***productivity values are extremely low; indeed, they may well be the lowest ever recorded at a MAPS locality*** in the 14-year history of the MAPS Program.

Table 4 summarizes the banding results at all ten 2002 NROC MAPS stations combined. Altogether, a total of 2762 birds of 62 species were captured during the 2002 breeding season. Newly-banded birds comprised 59.0% of the total captures. Overall, Wrentit was the most frequently captured, followed by Bushtit, Anna's Hummingbird, Spotted Towhee, Swainson's Thrush, Wilson's Warbler, California Towhee, "Western" Flycatcher, Costa's Hummingbird, Warbling Vireo, Bewick's Wren, House Finch, and Common Yellowthroat. The 11 most abundant breeding species at the ten NROC MAPS stations in 2002 (as determined by adults captured per 600 net-hours), in decreasing order, were Wrentit, Bushtit, Spotted Towhee, California Towhee, "Western" Flycatcher, Bewick's Wren, Common Yellowthroat, California Thrasher, House Finch, Ash-throated Flycatcher, and Orange-crowned Warbler (note that we could not calculate breeding populations for Anna's or Costa's hummingbirds because

individuals were not banded and thus could not be followed).

Of particular interest is the fact that ***no young were captured at any of the ten NROC MAPS stations for 29 of 39 species for which at least one adult was captured***. The proportion of young in the catch for all species pooled at all ten stations combined in 2002 was 0.04. This is likely the ***lowest overall productivity ever recorded*** at a MAPS location in the entire 14-year history of the MAPS Program.

B. Comparisons between 2001 and 2002 — Constant-effort comparisons between 2001 and 2002 were undertaken at the ten NROC MAPS stations for numbers of adult birds captured (adult population size; Table 5), numbers of young birds captured (Table 6), and proportion of young in the catch (productivity; Table 7). In each case, changes between 2001 and 2002 for the five coastal reserve stations are presented in Tables 5a, 6a, and 7a; for the five central reserve stations in Tables 5b, 6b, and 7b; and for all ten stations combined in Tables 5c, 6c, and 7c.

Adult population size for all species pooled for all ten stations combined increased by a highly significant 33.9% ($P < 0.01$) between 2001 and 2002 (Table 5c). Increases were recorded for 20 of 43 species for all stations combined, a proportion not significantly greater than 0.50 ($P = 0.729$). The overall adult population size for all species pooled increased at eight of the ten stations by amounts ranging from 12.6% at Sycamore Hills to 84.7% at Round Canyon (Tables 5a and 5b). Decreases in the adult population size for all species pooled were recorded at Irvine Park (-12.0%) and Little Sycamore Canyon (-32.3%). The proportion of increasing species was significantly greater than 0.50 at Upper Wood Canyon ($P = 0.039$) and near-significantly greater than 0.50 at Little Sycamore Canyon ($P = 0.067$). A highly significant increase in the number of adults captured for all stations combined was recorded for Wrentit, and significant increases in the number of adults captured for all stations combined were recorded for "Western" Flycatcher, Bushtit, and California Thrasher. A highly significant decrease in the number of adults captured for all stations combined was recorded for Lesser Goldfinch, and a significant decrease in the number of adults captured for all stations combined was recorded for Bullock's Oriole.

Adult populations for all species pooled increased by a non-significant 19.7% for the five coastal reserve stations combined (Table 5a), and increased by a significant 49.1% ($P < 0.05$) for the five central reserve stations combined (Table 5b). Increases were recorded for 23 of 42 species at the five coastal reserve stations combined, and for 19 of 43 species at the five central reserve stations combined, proportions not significantly greater than 0.50 ($P = 0.322$ and $P = 0.820$, respectively). Significant or highly significant decreases in the numbers of adults captured for the five coastal reserve stations combined were recorded for Lesser Goldfinch, California Towhee, and Bullock's Oriole, and a near-significant decrease was recorded for Rufous-crowned Sparrow, while no such increases were recorded for the five coastal reserve stations combined. In contrast, significant or highly significant increases in the number of adults captured for the five central reserve stations combined were recorded for "Western" Flycatcher, Wrentit, and California Thrasher, and a near-significant increase was recorded for Bushtit, while significant or highly significant decreases were noted for the five central reserve stations combined only for Bullock's Oriole and Lesser Goldfinch. The highly significant increase in the number of adults

for all species pooled and the four relatively common species that significantly increased (compared with two relatively less common species that significantly decreased) for all stations combined, resulted in a substantial increase in adult populations over the entire reserve. A comparison of these data between the two areas indicates that the increase in adult populations was more substantial at the central-reserve than at the coastal-reserve stations.

The number of young birds captured of all species pooled at all six stations combined decreased between 2001 and 2002 by a highly significant -94.5% (Table 6c). Decreases were recorded for 32 of 34 species for all stations combined, a proportion highly significantly greater than 0.50 (P = 0.000). Captures of young for all species pooled decreased at each of the ten stations by amounts ranging from -85.0% at Upper Weir Canyon to -100.0% at Irvine, with no increase at any station. The proportion of decreasing species was highly significantly greater than 0.50 at each of the ten stations (P = 0.000 at each station). Highly significant decreases in the number of young captured for all stations combined were recorded for 19 species (Nuttall's Woodpecker, Black Phoebe, Western Scrub-Jay, Oak Titmouse, Bushtit, Bewick's Wren, House Wren, Wrentit, Northern Mockingbird, California Thrasher, Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, California Towhee, Rufous-crowned Sparrow, Song Sparrow, Black-headed Grosbeak, Blue Grosbeak, and Lesser Goldfinch), and a near-significant decrease in the number of young captured for all stations combined was recorded for California Gnatcatcher. No such increase in the number of young birds captured was recorded for any species at the NROC MAPS stations. Indeed, ***only 54 young birds were captured at all stations combined in 2002 (compared to 983 in 2001)***, and 25 of these 54 were young House Finches, one of only two species to show an increase in 2002 in the number of young captured ("Western" Flycatcher was the other species).

In contrast to the between-year changes in adult populations, the changes between 2001 and 2002 in the number of young birds captured were very similar at both the coastal and central reserve stations (Tables 6a and 6b, respectively). Numbers of young for all species pooled decreased by a highly significant -96.6% over the five coastal reserve stations combined, and decreased by a highly significant -92.2% over the five central reserve stations combined. Decreases were recorded for 29 of 30 species at the five coastal reserve stations combined, and for 31 of 33 species at the five central reserve stations combined, proportions highly significantly greater than 0.50 (P = 0.000 at both reserves). Fourteen species showed highly significant decreases in numbers of young for the five coastal reserve stations combined, and a different set of fourteen species showed highly significant decreases in numbers of young for the five central reserve stations combined (Tables 6a and 6b). These results indicate that the drastic decline between 2001 and 2002 in the numbers of young birds captured occurred on both a reserve-wide and species-wide basis.

With adult populations increasing and numbers of young decreasing drastically, productivity (the proportion of young in the catch) showed a highly significant decrease of -0.442 (-92.5%) from 0.478 in 2001 to 0.036 in 2002 for all species pooled and all stations combined (Table 7c). Decreases in productivity were noted at each of the ten stations, by amounts ranging from -0.400 at Emerald Canyon to -0.518 at Little Sycamore Canyon (Tables 7a and 7b). The proportion of

species with decreasing productivity was highly significantly greater than 0.50 at all stations combined, as well as at Round Canyon and Upper Weir Canyon ($P = 0.000$ at each), and was significantly or near-significantly greater than 0.50 at Little Sycamore Canyon ($P = 0.011$), Emerald Canyon ($P = 0.029$), Whiting Ranch ($P = 0.032$), Upper Wood Canyon ($P = 0.046$), Upper Laurel Canyon ($P = 0.048$), and Irvine Park ($P = 0.090$). Fifteen species (Nuttall's Woodpecker, Oak Titmouse, Bushtit, Bewick's Wren, House Wren, Wrentit, California Thrasher, Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, California Towhee, Rufous-crowned Sparrow, Song Sparrow, Blue Grosbeak, and Lesser Goldfinch) showed highly significant decreases in productivity across all stations, two species (Cactus Wren and Black-headed Grosbeak) showed significant decreases in productivity, and three species (California Gnatcatcher, Northern Mockingbird, and Bullock's Oriole) showed near-significant decreases in productivity, while only a single species ("Western" Flycatcher) showed an increase in productivity which, however, was highly significant. Six species showed no changes in productivity, it being 0.000 in both years.

As with the between-year changes in numbers of young, the changes in the proportion of young in the catch between 2001 and 2002 very similar at both the coastal and central reserve stations. Proportion of young in the catch for all species pooled decreased by a highly significant -0.453 (-94.8%) over the five coastal reserve stations combined, and decreased by a highly significant -0.433 (-90.4%) over the five central reserve stations combined. Decreases in productivity were noted for 23 of 30 species at the five coastal reserve stations combined, and for 25 of 31 species at the five central reserve stations combined, proportions highly significantly greater than 0.50 ($P = 0.003$ and $P = 0.000$, respectively). For the five coastal reserve stations combined, ten species (Bushtit, Bewick's Wren, House Wren, Wrentit, California Thrasher, Orange-crowned Warbler, Common Yellowthroat, California Towhee, Rufous-crowned Sparrow, and Song Sparrow) showed highly significant decreases in productivity, five species (Nuttall's Woodpecker, Hutton's Vireo, Cactus Wren, Spotted Towhee, and Lesser Goldfinch) showed significant decreases, and two species (Western Scrub-Jay and Bullock's Oriole) showed near-significant decreases in productivity. "Western" Flycatcher was the only species to show an increase in productivity between 2001 and 2002 in the coastal reserve (its increase was near-significant). For the five central reserve stations combined, eight species (Bushtit, Bewick's Wren, House Wren, Wrentit, Common Yellowthroat, Spotted Towhee, California Towhee, and Rufous-crowned Sparrow) showed highly significant decreases in productivity, seven species (Nuttall's Woodpecker, Oak Titmouse, Cactus Wren, California Thrasher, Song Sparrow, Black-headed Grosbeak, and Blue Grosbeak) showed significant decreases, and two species (California Gnatcatcher and Bullock's Oriole) showed near-significant decreases in productivity. "Western" Flycatcher and House Finch were the only species in the central reserve to show an increase in productivity between 2001 and 2002 (neither increase was significant). ***These results confirm that a highly significant and nearly complete decline in productivity between 2001-2002 occurred on both a reserve-wide and species-wide basis.***

C. Three-year mean population size and productivity values — Mean numbers of individual adults (an index of adult population size) and young captured per 600 net-hours, and proportion of young in the catch (an index of productivity), averaged over the three-year period 2000-2002,

are presented in Table 8 for the six stations that operated for each of those three years. Examination of all-species-pooled values suggests that adult population sizes tended to be slightly higher at the three coastal reserve stations (Little Sycamore Canyon, Upper Laurel Canyon, and Upper Wood Canyon; mean 125.3 adults captured) than at the three central reserve stations (Weir Canyon, Irvine Park, and Upper Weir Canyon; mean 107.2 adults captured). Additionally, adult population sizes tended to be somewhat higher at housing development (Upper Wood Canyon and Upper Weir Canyon; mean 129.4) and road-edge (Upper Laurel Canyon and Irvine Park; mean 123.7 adults captured) stations than at core stations (Little Sycamore Canyon and Weir Canyon; mean 95.7 adults captured). The mean number of young birds captured for all species pooled followed the same pattern as adults, with mean captures at the coastal reserve stations (mean 68.6) tending to be slightly higher than at the central reserve stations (mean 63.5). Similarly, housing development stations tended to have the highest mean captures of young birds (mean 82.2), followed by road-edge stations (mean 62.7), with the lowest mean captures at core stations (mean 53.4). Although the mean numbers of both adult and young birds tended to be higher at the coastal reserve, productivity (the proportion of young in the catch) for all species pooled tended to be quite similar, but very slightly higher, at the central reserve (mean 0.34) than coastal reserve (mean 0.31) stations. This was due to the larger difference in mean captures of adults between the coastal and central stations than in mean captures of young birds. Productivity values for all species pooled also tended to be highest at the housing development stations (mean 0.36), but, unlike the pattern in numbers of adults and young captured, productivity values for all species pooled at the core stations (mean 0.31) tended to be very slightly higher than those at the road-edge stations (mean 0.295). All of these differences, and especially the analogous differences for individual species, are presented more usefully as results of multivariate ANOVA analyses.

Table 8 does, however, allow us to compare, for each station individually and for all stations combined, both mean indices of adult breeding population size and mean productivity indices among the various species. Clearly, for all stations combined, the species with the largest mean adult breeding population size was Wrentit (25.2 adults per 600 net-hours), followed, in decreasing order, by Bushtit, Spotted Towhee, and California Towhee, and then, with much smaller population sizes ($\leq$ 6.2 adults per 600 net-hours), "Western" Flycatcher, Lesser Goldfinch, Common Yellowthroat, Bewick's Wren, House Finch, Orange-crowned Warbler, Ash-throated Flycatcher, California Thrasher, and Song Sparrow. The remaining species were captured at rates of less than 2.0 adults per 600 net-hours. Among the 13 species with mean indices of adult population size greater than 2.0 adults per 600 net-hours, House Finch had the highest productivity (0.49), followed in decreasing order by California Thrasher (0.43), Bewick's Wren (0.40), Wrentit and Song Sparrow (0.39), and Common Yellowthroat (0.35) with relatively high productivity; followed by California Towhee (0.31), Orange-crowned Warbler (0.30), Spotted Towhee (0.28), and Bushtit (0.25) with about average productivity; and finally by Lesser Goldfinch (0.13), Ash-throated Flycatcher (0.12), and "Western" Flycatcher (0.01) with low or very low productivity.

D. Multivariate analyses of variance of adult population size — Multivariate analyses assessing variation in numbers of adults captured are shown in Figure 1 for all species pooled and in

Figures 2-16 for the 14 target species as well as House Finch.

For all species pooled, there was little variation in numbers of adults captured by year (controlling for location and landscape); numbers were slightly higher in 2002, and slightly lower in 2001, than those of 2000 (Fig. 1), but none of these comparisons were close to significant. Non-significant differences in numbers of adults captured by year were also recorded for 10 of the 15 individual species. For Ash-throated Flycatcher (Fig. 3) and Rufous-crowned Sparrow (Fig. 13), numbers of adults captured in 2001 were near-significantly higher than in 2000. For Bushtit (Fig. 4) and Wrentit (Fig. 7), numbers of adults captured were significantly and highly significantly (respectively) higher in 2002 than in 2000. For Lesser Goldfinch (Fig. 16), numbers of adults captured were significantly lower in 2002 than in 2000. Thus, there was generally little interannual variation in numbers of adults captured at NROC in 2000-2002, with the notable exception of Bushtit and Wrentit, each of which showed significant increases in population size through the period. Because these are the two most commonly caught species at NROC, it would appear that increases in these two species were responsible for driving the overall increases in numbers of adults captured noted between 2001 and 2002 (Fig. 1).

Numbers of adults captured also did not vary by geographic location (controlling for year and landscape); numbers were slightly higher in the coastal reserve than in the central reserve (Fig. 1) but this comparison was not significant. Non-significant relationships in numbers of adults captured by geographic location were also recorded for eight of the 15 individual species. For Bewick's Wren (Fig. 5), House Wren (Fig. 6), and Rufous-crowned Sparrow (Fig. 13), numbers of adults captured in the central reserve were significantly or near-significantly higher than those caught in the coastal reserve. For Orange-crowned Warbler (Fig. 9), Common Yellowthroat (Fig. 10), Spotted Towhee (Fig. 11), and Song Sparrow (Fig. 14), numbers of adults captured in the coastal reserve were significantly or near-significantly higher than those caught in the central reserve. These differences reflect the natural history of these species, the former group preferring drier inland habitats and the latter group preferring the cooler environments of the coastal fog belt.

For all species pooled, there was also little variation in numbers of adults captured by local landscape (controlling for year and location); numbers were slightly higher at both road-edge and housing-development stations than at core stations (Fig. 1), but none of these comparisons were close to significant. Non-significant relationships in numbers of adults captured by landscape were also recorded for eight of the 15 individual species. For Bushtit (Fig. 4), Wrentit (Fig. 7), Song Sparrow (Fig. 14), and House Finch (Fig. 15) numbers of adults captured at housing-development stations were near-significantly or significantly higher than those caught at core stations. For Bewick's Wren (Fig. 5) and House Wren (Fig. 6), numbers of adults captured were highly significantly and near-significantly (respectively) lower at road-edge stations than at core stations. For Common Yellowthroat (Fig. 10) and Song Sparrow (Fig. 14), numbers of adults captured at road-edge stations were significantly higher than those caught at core stations.

For all species pooled, numbers of adults captured were significantly higher at Upper Laurel

Canyon, and near-significantly higher at Upper Weir Canyon, than at Little Sycamore Canyon, the reference station (Fig. 1), when controlling for year. Significant or near-significant variation in adults captured by station (as compared with those at Little Sycamore Canyon) were recorded for 13 of 15 species and included 24 comparisons (Figs. 2-16). Nineteen of these comparisons involved other stations with higher captures. Many of these involved central reserve stations (Weir and Upper Weir canyons and Irvine Park), where captures of certain species (e.g., Bewick's Wren, House Wren, and Rufous-crowned Sparrows, as noted above) were higher than at the coastal reference station. Similarly, three of the six negative comparisons involved Orange-crowned Warbler (Fig. 9), a coastal species which was caught in lower numbers at these central stations. Interestingly, captures of Wrentit (Fig. 9) were higher at three of five other stations than they were at Little Sycamore Canyon. Otherwise, differences among stations largely reflected differences in geographic location and/or landscape, as previously discussed.

E. Logistic regression analyses of productivity — The odds ratios for productivity indices for all species pooled are presented in Figure 17, and the odds ratios are presented for 14 individual species, in phylogenetic order, in Figures 18-31 (data were insufficient to allow logistic regression analyses to be conducted on "Western" Flycatcher.

For all species pooled, when controlling for geographic location and local landscape, productivity in 2002 was highly significantly ($P = 0.000$) lower than in 2000, while productivity in 2001 was highly significantly ($P = 0.000$) higher than in 2000. Productivity was lower in 2002 than in 2000 for all 14 individual species. Productivity was zero in 2002 for 11 (Ash-throated Flycatcher, Bushtit, Bewick's Wren, California Thrasher, Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, California Towhee, Rufous-crowned Sparrow, Song Sparrow, and Lesser Goldfinch) of the 14 species, and thus significance values could not be generated. Productivity was highly significantly ($P = 0.000$) lower in 2002 than in 2000 for Wrentit (Fig. 22), and was lower, but not significantly lower, for House Wren (Fig. 21) and House Finch (Fig. 30). In contrast, productivity was higher in 2001 than in 2000 for eight species (Bewick's Wren, House Wren, California Thrasher, Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, California Towhee, and Song Sparrow), with highly significant differences for Orange-crowned Warbler (Fig. 24) and Common Yellowthroat (Fig. 25) and significant differences for House Wren (Fig. 21) and Song Sparrow (Fig. 29). Productivity in 2001 was lower than in 2000 for the remaining six species but was not significantly lower for any of them.

Productivity was near-significantly higher ($P = 0.078$) in the central reserve than in the coastal reserve for all species pooled when controlling for year and local landscape (Fig. 17). Productivity was zero in the coastal reserve for Ash-throated Flycatcher (Fig. 18), was highly significantly greater in the central reserve than the coastal reserve for Spotted Towhee (Fig. 26), and tended to be higher in the central reserve than the coastal reserve for five other species (Bushtit, California Thrasher, Common Yellowthroat, California Towhee, and Lesser Goldfinch). In contrast, five species (Bewick's Wren, Wrentit, Rufous-crowned Sparrow, Song Sparrow, and House Finch) tended to have somewhat lower productivity in the central reserve than in the coastal reserve, although none of the differences were significant. Comparisons

could not be made for House Wren, for which all of the stations included in the analysis were located in the central reserve, nor for Orange-crowned Warbler, for which all of the stations were located in the coastal reserve.

When controlling for year and geographic location, productivity for all species pooled was highly-significantly greater at stations bordering housing developments than at core stations whereas productivity tended to be slightly, but not significantly, lower at road-edge stations than at core stations (Fig. 17). Productivity at stations bordering housing developments was significantly higher than that at core stations for House Wren (Fig. 21), Spotted Towhee (Fig. 26), and California Towhee (Fig. 27), and was non-significantly higher for four other species (Bushtit, Bewick's Wren, Wrentit, and Lesser Goldfinch); but it was significantly lower at housing development stations for Orange-crowned Warbler (Fig. 24) and tended to be lower at housing development stations for four other species (Ash-throated Flycatcher, California Thrasher, Common Yellowthroat, and Rufous-crowned Sparrow). Comparisons could not be made for Song Sparrow (which wasn't found at core stations) or for House Finch (which was only found at housing development stations).

Productivity was zero at road-edge stations for Orange-crowned Warbler (Fig. 24) and tended to be lower than at core stations for three species (Bewick's Wren, Wrentit, and Lesser Goldfinch) and for all species pooled, but with no significant differences for any species. In contrast, productivity tended to be higher at road-edge than at core stations for seven species (Bushtit, House Wren, California Thrasher, Common Yellowthroat, Spotted Towhee, California Towhee, and Rufous-crowned Sparrow), but again with no significant differences. No comparisons between road-edge and core stations could be made for Ash-throated Flycatcher, Song Sparrow, or House Finch. Overall, except for Orange-crowned Warbler, little difference was noted between productivity at road-edge and core stations.

Figure 17 shows that productivity for all species pooled varied substantially among stations when controlling for year. Productivity for all species pooled was significantly higher at Upper Wood Canyon and Upper Weir Canyon than at the reference station, Little Sycamore Canyon, and was
non-significantly higher at Weir Canyon and Irvine Park. Only Upper Laurel Canyon (a road-edge station) showed lower productivity for all species pooled than the reference station, although this difference was not significant. For Lesser Goldfinch productivity was zero at Upper Wood Canyon and Irvine Park. For seven additional species, involving 15 comparisons, productivity also varied significantly or near-significantly among stations when controlling for year. For 12 of these comparisons, productivity was higher at other stations; in particular, productivity of Bushtit (Fig. 19) and Spotted Towhee (Fig. 26) was higher at multiple other stations than at Little Sycamore Canyon. The only comparisons in which productivity was significantly higher at Little Sycamore Canyon involved lower productivity of Wrentit at Upper Laurel Canyon (Fig. 22) and of Orange-crowned Warbler at Upper Wood Canyon. As with comparisons involving adults captured, differences in productivity among stations largely reflected differences in geographic location and/or landscape, as previously discussed.

F. Four-year trends in adult population size and productivity-- "Chain" indices of adult population size are presented in Figure 12 for the 14 target species (with an average of at least seven individual adults captured per year) and for all species pooled at the four stations operated over the four years 1999-2002, Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park. See Methods for an explanation of the calculations used to obtain these indices. We used the slope of the regression line for each species to calculate the Annual Percentage Change (*APC*) for the population. *APC* along with the standard error of the slope (SE), the correlation coefficient (*r)*, and the significance of the correlation (*P*) for each target species and for all species pooled are included in Figure 1.

Population trends for nine species (Bewick's Wren, House Wren, Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, California Towhee, Rufous-crowned Sparrow, Song Sparrow, and Lesser Goldfinch) and all species pooled showed substantial decreases ($r < -0.5$) over the four years 1999-2002. Of these, Spotted Towhee showed a significant decline and Orange-crowned Warbler and Song Sparrow showed near-significant declines. The remaining five species ("Western" Flycatcher, Ash-throated Flycatcher, Bushtit, Wrentit, and California Thrasher) showed relatively stable populations and no substantial trend (absolute $r < 0.5$, $SE \leq 0.219$). Two of these five ("Western" Flycatcher and Bushtit), however, showed declining tendencies. Overall therefore, as indicated by *APC* values, population trends for eleven species and all species pooled were negative, whereas only three species (Ash-throated Flycatcher, Wrentit, and California Thrasher) showed (non-substantial) positive trends. The annual percentage change (*APC*) in populations between 1999 and 2002 varied from -21.1% for Song Sparrow to +10.0% for Ash-throated Flycatcher, and was -7.4% for all species pooled.

Figure 13 indicates generally erratic fluctuations in productivity during the four-year period 1999-2002, with few substantial trends. Productivity trends for three species ("Western" Flycatcher, California Thrasher, and Lesser Goldfinch) showed substantial decreases ($r < -0.5$), with that of Lesser Goldfinch being significant, while no species showed a substantial increase. Productivity trends for three species (Ash-throated Flycatcher, Bushtit, and Spotted Towhee) were relatively stable, with absolute $r < 0.5$ and $SE \leq 0.125$ in all cases. Productivity trends for the remaining eight species (Bewick's and House wrens, Wrentit, Orange-crowned Warbler, Common Yellowthroat, California Towhee, Rufous-crowned Sparrow, and Song sparrow) and all species pooled showed erratic fluctuations, but no substantial trend (absolute $r < 0.5$ and $SE > 0.125$). Many species showed lower productivity in 1999 and 2002 and higher productivity in 2000-2001. The annual change in the index of productivity (*PrT*) between 1999 and 2002 varied between -0.096 for Lesser Goldfinch and +0.047 for Orange-crowned Warbler, and was -0.028 for all species pooled. Overall, as indicated by *PrT* values, productivity trends for ten species and all species pooled were negative, whereas trends for only four species were positive. This pattern of four-year productivity trends contrasts remarkably with the previous three-year pattern in which 12 of 14 species and all species pooled showed increasing productivity trends. The difference was, of course, caused by the extremely low productivity in 2002.

Estimates of Adult Survivorship

Using four years of data from the four stations operated over the years 1999-2002 (Little

Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park), estimates of adult survival and recapture probabilities could be obtained for eight of the 14 target species breeding at NROC. Maximum-likelihood estimates of annual adult survival probability, recapture probability, and proportion of residents among newly captured adults from the time-constant transient model are presented in Table 9 for each of the eight species.

Annual adult survival-rate estimates ranged from a low of 0.351 for Spotted Towhee to a high of 0.890 for Rufous-crowned Sparrow, with a mean of 0.528 for the eight species. Estimates of recapture probability for the eight species varied from 0.057 for Rufous-crowned Sparrow to 0.762 for Bewick's Wren, with a mean of 0.391. Estimates of the proportion of residents among newly captured adults ranged from 0.220 for Song Sparrow to 1.000 for Spotted Towhee, with a mean of 0.587. Based on data from other MAPS stations in California, the survival-rate estimates from NROC for Bushtit, Bewick's Wren, Wrentit, and Song Sparrow appeared to be about as high, or possibly higher, than those from other locations. These initial estimates, therefore, suggest that adult survival rates at NROC, at least for these four species, were generally quite good. However, the survival-rate estimates for Spotted Towhee and California Towhee were substantially lower than those from other locations. Both Spotted and California Towhees also showed substantial declines in adult population sizes, with Spotted Towhee showing a significant ($P < 0.05$) decline of -12.6% annually. It is possible that these declines were due, at least in part, to low adult survivorship. Data are not available from elsewhere to compare survival rates for the remaining two species, California Thrasher and Rufous-crowned Sparrow. Moreover, the precision of the survival-rate estimates from NROC for these two species are too low (CV(ϕ) > 60%) to permit useful comparison.

The mean coefficient of variation of the annual adult survival-rate estimate, CV(ϕ), for the eight species was 36.1%. Survival rate estimates were previously obtained from a different four years (1998-2001) of data from only two stations (Little Sycamore Canyon and Weir Canyon) for five of these eight species (Bushtit, Bewick's Wren, Wrentit, Spotted Towhee, and California Towhee). The mean CV(ϕ) for those five species from four years of data at four stations (25.4%) was notably lower than the mean CV(ϕ) for those five species from four years of data at two stations (29.3%), indicating a substantial improvement in precision as a result of data from the additional two stations. However, the survival rate estimates from four years (1999-2002) of data from four stations were lower for all five species than the survival rate estimates from four years (1998-2001) of data from two stations, indicating either a decrease in survivorship over the last year or relatively low survivorship at the two additional stations.

DISCUSSION OF RESULTS

Overshadowing all other results in 2002 was documentation of a nearly complete reproductive failure at the NROC MAPS stations, the likes of which have not been recorded within the MAPS program since its inception in 1989. No young were captured at any of the ten NROC MAPS stations for 29 of 39 species for which at least one adult was captured. Furthermore, only 54 young birds were captured at all stations combined in 2002 (compared to 983 in 2001), and 25 of these 54 were young House Finches. Mean productivity for all stations combined was just 0.04, the lowest ever recorded at a MAPS location, and ranged from 0.00 at Irvine Park to 0.09 at Upper Weir Canyon. Thus, this reproductive failure was both region wide and species wide.

Examination of weather data indicates that the extremely dry conditions experienced in Southern California during the winter and early spring were likely related to this reproductive failure (Hamilton 2003). Indeed, only 0.93 inches of rain fell at the San Diego WSO Airport weather station (from http://www.wrcc.dri.edu/cgi-bin/cliMONtpre.pl?casand) during December 2001-February 2002, representing the lowest such 3-month total in the past 100 years (mean 5.67 inches, range 0.93-16.38 inches). The next lowest total was 1.50 inches in 1961. Such extremely dry conditions prohibit growth of vegetative matter during the spring, which in turn results in a paucity of insect and other vegetative and invertebrate prey resources that landbirds need to feed their young (Hamilton 2003). Adults were also likely to have been in poor reproductive condition due to the lack of food. The one species that was an exception, House Finch, was one of few seed-eaters among the target species and could have relied on bird feeders in it's preferred housing-development habitat to successfully rear young in 2002. In Dec-Feb 2002-2003, 6.87 inches of rain fell, which should result in better productivity during the breeding season of 2003.

Using multivariate analyses we assessed variation in numbers of adults captured by year, geographic location, landscape, and station for all species pooled and for 15 target species, at six stations operated in 2000-2002. There was little variation in numbers of adults captured by year; numbers were slightly and non-significantly higher in 2002 and lower in 2001 than they were in 2000. The only notable inter-annual differences among species were for Bushtit and Wrentit, for which adults captured in 2002 were significantly higher than those captured in 2000.

Numbers of adults captured also did not vary greatly by geographic location, those for all species pooled being slightly and non-significantly higher in the coastal-reserve than in central-reserve stations. Significant differences among species were as expected, with species that prefer inland habitats (e.g., Bewick's Wren, House Wren, and Rufous-crowned Sparrow) showing higher breeding populations in the central reserve, and species preferring coastal habitats (e.g., Orange-crowned Warbler, Common Yellowthroat, Spotted Towhee, and Song Sparrow) showing higher breeding populations in the coastal reserve. There was also only slight variation according to landscape, numbers of all species pooled being slightly and non-significantly higher at both road-edge and housing-development stations than at core stations. Several species, including Bushtit, Wrentit, Song Sparrow, and House Finch showed significantly or near-significantly higher numbers of adults captured at housing-development stations. These species generally rely

on larger shrubs or trees for nesting, which explains this correlation. For two species, Bewick's Wren and House Wren, numbers of adults captured were significantly or near-significantly lower at road-edge stations than at core stations, perhaps indicating the sensitivity of these species to human disturbance or to vehicle pollutants. Differences among stations were also generally slight, and largely reflected differences in geographic location and/or landscape.

Logistic regression analyses on data from the same six stations operated during 2000-2002 confirmed the highly significant lack of productivity recorded in 2002. Given this, it is not surprising that variation by geographic location, landscape, and station were similar to that reported last year using two years of data. Productivity was near-significantly higher in the central reserve than in the coastal reserve for all species pooled, and productivity was significantly greater at housing-development stations than at core stations. As reported last year, productivity at both the housing-development and road-edge stations was at least as high as at the core stations during 2000-2002. As with adults captured, differences in productivity among stations largely reflected differences in geographic location and/or landscape.

Capture data from the four stations that were operated for four consecutive years (1999-2002) suggests that adult population sizes have generally declined during this period at NROC. Population trends for 11 of 14 species showed declines. For nine species and all species pooled population trends showed substantial decreases, with those of Spotted Towhee, Orange-crowned Warbler, and Song Sparrow showing significant or near-significant declines. By contrast only three species showed non-substantial increases. Populations generally drop after years of poor productivity (see below), so it is likely that these declines will become even more widespread and severe with the inclusion of 2003 data.

Productivity trend analyses generally indicated fluctuations in productivity during the four-year period 1999-2002, with few substantial trends. The productivity trend for only one species, Lesser Goldfinch, was significant, in this case showing a decline. Productivity trends for the eight species and for all species pooled showed erratic fluctuations, but no substantial trend. Many species showed lower productivity in 1999, higher productivity in 2000 and 2001, and extremely low productivity in 2002, thus showing overall declines. This is in contrast to the three-year (1999-2001) patterns in which 12 of 14 species and all species pooled showed increasing productivity trends.

Overall, MAPS data from NROC has shown some generally station-wide and species-wide patterns. Adult breeding populations decreased slightly between 1998 and 1999, decreased significantly between 1999 and 2000, decreased slightly again between 2000 and 2001, and increased substantially and significantly between 2001 and 2002. In contrast, productivity generally followed the opposite pattern, declining substantially between 1998 and 1999, increasing substantially and significantly between 1999 and 2000, increasing slightly between 2000 and 2001, and decreasing substantially and significantly between 2001 and 2002. This alternating population dynamic has been noted at other MAPS stations, and we believe it relates to density-dependent effects on productivity and recruitment along with lower productivity of first-time breeders. For example, low productivity in 1999 led to decreased adult population

sizes in 2000, which were then comprised of more experienced breeders that apparently enjoyed less intra- and inter-specific competition. This, in turn led to good reproductive success in 2000, which led to increased populations with less-experienced breeders in 2001, and so on. Of concern, as mentioned above, is that this pattern has also been superimposed upon a general decline in populations, which will very likely become even more widespread and severe in 2003 based on the reproductive failure of 2002.

We have found the alternating "productivity/population" dynamic described above at other groups of MAPS stations, especially those in geographic areas that appear to lack dramatic interannual changes in weather (e.g., extreme droughts or excessive snowpack accumulations). Disruptions of this alternating cycle at these other MAPS stations have generally appeared to be related to unusually favorable or unfavorable weather or to pronounced changes in the environment (perhaps caused by fire or severe insect defoliation). In this respect we might expect the severe drought conditions of the winter of 2001-2002 at NROC to disrupt this cycle, although the resultant poor productivity occurred during a year (2002) when low productivity was already expected based on higher breeding populations. At least we can now predict better productivity in 2003, which will hopefully cause breeding populations eventually to rebound at NROC.

Using nine or ten years of data from other MAPS stations, (Nott et al. 2002b), we have been able to examine relationships between global climate cycles (such as the El Niño/Southern Oscillation and the North Atlantic Oscillation) and productivity, and have found significant correlations. In particular, we have found that productivity in the Pacific Northwest and most other locations in western and southern United States is strongly related to the mean monthly El Niño/Southern Oscillation Precipitation Index (ESPI; a measure of the effects of El Niños and La Niñas) in such a manner that productivity averages higher during El Niño conditions (such as those in 1998) than during La Niña conditions (such as those in 1999). Once more years of data have accumulated at NROC, we will be able to better understand avian population dynamics on NROC and in the Southern California region generally and their relationship to global climate cycles. Given the reproductive failure of 2002, it will be of particular interest to compare variation in annual breeding success with variation in rainfall totals during the previous winter and spring.

With four years of data, survival estimates were obtained for eight species using modified CJS mark-recapture models. We have noted substantial improvements in precision with each additional year of data (so far, up to ten years) at other MAPS stations. These predictions are in agreement with simulations of MAPS data completed by Dan Rosenberg as part of his evaluation of the statistical properties of the MAPS Program (Rosenberg et al. 1996, 1999). We expect to be able to estimate adult survival rates for as many as 14 target species at NROC once more years of data from all ten stations are available. Time-dependence in estimates of survivorship, recapture probability, and/or proportion of residents will also be available when at least five years of data have accumulated from six or more stations.

We must emphasize that the population trend, productivity trend, and survival rate results

presented here are based on only four years of data from six stations. Thus, the short-term patterns identified may not be representative of the true long-term, large-scale population dynamics. Moreover, the indices and estimates of primary demographic parameters presented here have relatively low precision and statistical power because of the limited number of years and small number of stations. This, of course, will improve dramatically as more years of data accumulate from all ten stations now being operated on the NROC.

Previous extensive analyses conducted on 1992-1996 data (DeSante et al. 1997) have indicated that the indices and estimates of primary demographic parameters (productivity and survivorship) of common landbird species produced by the MAPS Programs could adequately predict the relative short-term population trends of those species (DeSante et al. 1999). In addition, late-summer mist netting has been shown to provide accurate indices of region-wide productivity in targeted endangered species suggesting that "mist-netting programs like MAPS and the Constant Effort Sites used in Britain can provide useful measures of temporal patterns, large-scale spatial patterns, and year-specific patterns in avian productivity" (Bart et al. 1999). As a result, the indices and estimates of primary demographic parameters produced by MAPS are proving to be extremely useful for the management and conservation of landbirds at specific locations and, in combination with similar data from other areas, across all of North America. We conclude that the MAPS protocol is very well-suited to provide one component of NROC's long-term ecological monitoring efforts, and can provide critical data to aid in resolving problems associated with declining landbird populations in Southern California.

Finally, in addition to the analyses involving climate cycles, we have initiated two broad-scale analyses on longer-term data from other locations to help us further understand the population dynamics of landbirds and to allow us to identify potential management actions to reverse population declines and maintain stable or increasing populations. First, by modeling spatial variation in vital rates as a function of spatial variation in population trends, we are beginning to determine the proximate demographic causes of population trends for species at multiple spatial scales (DeSante et al. 2001). Among Gray Catbird populations, for example, we found that adult survival-rate estimates varied appropriately between areas of increasing vs. decreasing population trends while productivity indices were independent of area, suggesting that low survivorship was driving the declining populations in this species. Second, by modeling vital rates as a function of landscape-level habitat characteristics, we have found that patterns of landscape structure detected within a two- to four-kilometer radius area of each station are good predictors not only of the numbers of birds of each species captured but, more importantly, of their productivity levels as well (Nott 2000). That study revealed the existence of threshold values of critical habitat characteristics, such as mean forest patch size, above which productivity levels could be maximized, thus providing an extremely powerful tool to identify and formulate management actions aimed at increasing landbird populations. With additional funding from a variety of sources, we hope to undertaking such analyses with data from NROC as well as with data from all 500 stations that are now being operated across North America. We also hope to include estimates of juvenile recruitment and indices of first-year survival in future analyses in order to fully understand what parameters are most affecting population changes in each target species. We are excited by the prospect of conducting these analyses on data from NROC in

upcoming years.

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Table 1. Summary of the 2002 MAPS program on the Nature Reserve of Orange County.

Station					2002 operation				
Name	Code	No.	Major Habitat Type	Latitude-longitude	Avg. Elev. (m)	Number years of operation	Total number of net-hours[1]	No. of periods	Inclusive dates
Coastal Reserve Sites:									
Little Sycamore Canyon	LISY	12269	coastal sage scrub, scrub oak woodland, core	33°36'48"N,117°46'09"W	176	5	585.3 (574.7)	10	5/08-8/01
Emerald Canyon	EMCA	12308	coastal sage scrub in a steep canyon, core	33°34'26"N,117°46'85"W	264	2	536.7 (510.5)	10	5/10-8/03
Upper Laurel Canyon	UPLA	12293	coastal sage scrub, coast live oak woodland, road-edge	33°35'48"N,117°46'33"W	195	4	600.0 (540.0)	10	5/06-7/31
Upper Wood Canyon	UPWO	12294	coastal sage scrub, bordering housing development	33°35'30"N,117°44'41"W	140	3	596.7 (559.3)	10	5/05-7/31
Sycamore Hills	SYHI	12310	coastal sage scrub, bordering housing development	33°36'07"N,117°45'11"W	186	2	566.0 (564.0)	10	5/04-7/30
Central Reserve Sites:									
Weir Canyon	WEIR	12270	coastal sage scrub, coast live oak woodland, core	33°48'54"N,117°44'52"W	220	5	522.7 (522.7)	10	5/09-8/02
Round Canyon	ROCA	12309	coastal sage scrub, oak woodland, core	33°42'34"N,117°41'57"W	217	2	593.3 (581.0)	10	5/07-8/01
Irvine Park	IRPA	12292	coastal sage scrub, coast live oak woodland, road-edge	33°47'35"N,117°44'07"W	223	4	557.5 (549.5)	10	5/09-8/02
Upper Weir Canyon	UPWE	12295	coastal sage scrub, grassland, bordering housing development	33°50'20"N,117°44'22"W	329	3	580.3 (545.0)	10	5/03-7/30

Table 1. (cont.) Summary of the 2002 MAPS program on the Nature Reserve of Orange County.

Station						2002 operation				
Name	Code	No.	Major Habitat Type	Latitude-longitude	Avg. Elev. (m)	Number years of operation	Total number of net-hours[1]		No. of periods	Inclusive dates
Whiting Ranch	WHRA	12311	coastal sage scrub, oak woodland, bordering housing development	33º40'49"N,117º38'85"W	276	2	580.0	(580.0)	10	5/10-8/03
ALL STATIONS COMBINED							5718.5	(5503.3)	10	5/03-8/03

[1] Total net-hours in 2002. Net-hours in 2002 that could be compared in a constant-effort manner to 2001 are shown in parentheses.

Table 2a. Capture summary for the five coastal reserve MAPS stations operated on the Nature Reserve of Orange County in 2002.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	L. Sycamore Can. (core)			Emerald Canyon (core)			U. Laurel Canyon (road-edge)			U. Wood Canyon (housing)			Sycamore Hills (housing)		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
California Quail															
Mourning Dove											1				
Black-chinned Hummingbird		1						1			1			6	
Anna's Hummingbird		37			28			9			20			66	
Costa's Hummingbird		3			7			2			4			25	
Calliope Hummingbird		1			1			2			2			3	
Rufous Hummingbird					1									3	
Allen's Hummingbird		3			2						5			22	
Unidentified Selasphorus		5			1									12	
Unidentified Hummingbird					3									7	
Acorn Woodpecker				1											
Nuttall's Woodpecker	1						2						1		
Northern Flicker															
Western Wood-Pewee										1					
"Traill's" Flycatcher										1					
Hammond's Flycatcher															
"Western" Flycatcher	7	1		3			12		2	2			11		2
Black Phoebe											1				
Ash-throated Flycatcher	3			4			5			2			2		
Cassin's Kingbird							2								
Hutton's Vireo				3		2			1			2			
Warbling Vireo	5			6		3	18			16			15		
Western Scrub-Jay	2							1					1		1
Cliff Swallow				1			1								
Oak Titmouse													1		
Bushtit		2		10	2	9	35		8	21		9	39		18
White-breasted Nuthatch															
Cactus Wren															

Table 2a. (cont.) Capture summary for the five coastal reserve MAPS stations operated on the Nature Reserve of Orange County in 2002. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	L. Sycamore Can. (core)			Emerald Canyon (core)			U. Laurel Canyon (road-edge)			U. Wood Canyon (housing)			Sycamore Hills (housing)		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Bewick's Wren	2		2	4			2		1	4		3	3		1
House Wren				1			1			2			1		
Blue-gray Gnatcatcher	1		3												
California Gnatcatcher							1						1	1	
Swainson's Thrush	9			5			8		1	7		1	5		
Hermit Thrush							1								
Wrentit	15	1	16	40	1	33	25	1	25	42	1	48	17	6	29
Northern Mockingbird															
California Thrasher	3	1	1	3		1	4	1	2			1	1		
Phainopepla				6	1		1			1					
Orange-crowned Warbler	1			3		1	5		2	2		1	10		
Nashville Warbler													1		1
Yellow Warbler				1			2			2			8		
Black-throated Gray Warbler	1									1			1		1
Townsend's Warbler	2			2			2			10		3	3		
Hermit Warbler	2						1			9	1				
MacGillivray's Warbler	1		1	2											
Common Yellowthroat	6		1	13	1	7	9	2	7	8		5			
Wilson's Warbler	4			15		1	8			22		1	26		3
Yellow-breasted Chat							1								
Western Tanager										1			9		1
Spotted Towhee	10	1		20		5	5	1	2	9	1	7	6		3
California Towhee	1			3		3	11	2	4	2			1		
Rufous-crowned Sparrow	2												1	1	
Black-chinned Sparrow															
Grasshopper Sparrow							1								
Song Sparrow	2			3		6	3		7	2		3			
Lincoln's Sparrow															

Table 2a. (cont.) Capture summary for the five coastal reserve MAPS stations operated on the Nature Reserve of Orange County in 2002. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	L. Sycamore Can. (core)			Emerald Canyon (core)			U. Laurel Canyon (road-edge)			U. Wood Canyon (housing)			Sycamore Hills (housing)		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Golden-crowned Sparrow															
Black-headed Grosbeak				5		1				1			1		
Blue Grosbeak							3		1						
Lazuli Bunting										2			1		
Hooded Oriole													1		
Bullock's Oriole													2		
House Finch										15		1	10		
Lesser Goldfinch				2			2						4		
ALL SPECIES POOLED	80	56	24	156	48	72	171	22	63	185	37	85	183	152	60
TOTAL NUMBER OF CAPTURES		160			276			256			307			395	
NUMBER OF SPECIES	21	10	6	24	9	12	28	10	13	25	10	13	29	9	10
TOTAL NUMBER OF SPECIES		27			29			34			34			35	

Table 2b. Capture summary for the five central reserve MAPS stations operated on the Nature Reserve of Orange County in 2002.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Weir Canyon (core)			Round Canyon (core)			Irvine Park (road-edge)			U. Weir Canyon (housing)			Whiting Ranch (housing)		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
California Quail								1							
Mourning Dove								1							
Black-chinned Hummingbird		2			1			2			11			9	
Anna's Hummingbird		13			13			4			31			25	
Costa's Hummingbird		3			5			1			12			24	
Calliope Hummingbird		2									1				
Rufous Hummingbird															
Allen's Hummingbird		1			1			2			4			6	
Unidentified Selasphorus											2				
Unidentified Hummingbird					1									1	
Acorn Woodpecker							1		2						
Nuttall's Woodpecker	2		1	3					1			1	1		
Northern Flicker							1								
Western Wood-Pewee															
"Traill's" Flycatcher	1		1	1				1		2			4		
Hammond's Flycatcher				1											
"Western" Flycatcher	12			11		1	4			15			7		
Black Phoebe															
Ash-throated Flycatcher	4			1			5			4			6		1
Cassin's Kingbird															
Hutton's Vireo	2														
Warbling Vireo	7	1		4			4			3			4		
Western Scrub-Jay				2			2			2			3		
Cliff Swallow															
Oak Titmouse				5		6	2		1	2			2		1
Bushtit	5			25		3	6		9	32	2	17	18	3	4
White-breasted Nuthatch							1								
Cactus Wren	1			1									4		2

Table 2b. (cont.) Capture summary for the five central reserve MAPS stations operated on the Nature Reserve of Orange County in 2002. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Weir Canyon (core)			Round Canyon (core)			Irvine Park (road-edge)			U. Weir Canyon (housing)			Whiting Ranch (housing)		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Bewick's Wren	3		7	6		7			3	2		3	8		7
House Wren	2		2	7	1	4	1		2	2	1	2	1		
Blue-gray Gnatcatcher	1														
California Gnatcatcher				1									2		
Swainson's Thrush	14	1		11			19		3	31		8	11		1
Hermit Thrush										1					
Wrentit	23	1	17	78		47	3		23	29	1	18	66	2	45
Northern Mockingbird				1						1			1		
California Thrasher	3		1	7	1	3	2			4		2	7		1
Phainopepla										2					
Orange-crowned Warbler				6						2			2		
Nashville Warbler															
Yellow Warbler										1					
Black-throated Gray Warbler				2											
Townsend's Warbler	1			2						2					
Hermit Warbler															
MacGillivray's Warbler	1									3					
Common Yellowthroat				1						1			3	1	
Wilson's Warbler	6			2			4			8			6	1	2
Yellow-breasted Chat													1		
Western Tanager															
Spotted Towhee	12	1	4	15		5	4		7	22	1	3	36		8
California Towhee	22		5	10	1	3	6	1	1	8	1	2	8	1	2
Rufous-crowned Sparrow				2			3	1	1	3	1		1		3
Black-chinned Sparrow										1					
Grasshopper Sparrow															
Song Sparrow				1		2				2			10		1
Lincoln's Sparrow										1					

Table 2b. (cont.) Capture summary for the five central reserve MAPS stations operated on the Nature Reserve of Orange County in 2002. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Weir Canyon (core)			Round Canyon (core)			Irvine Park (road-edge)			U. Weir Canyon (housing)			Whiting Ranch (housing)		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Golden-crowned Sparrow										1					
Black-headed Grosbeak				3		1				1					
Blue Grosbeak							2								
Lazuli Bunting							1			2					
Hooded Oriole															
Bullock's Oriole															
House Finch				4						22			14		1
Lesser Goldfinch				1						5			5		1
ALL SPECIES POOLED	122	25	38	214	24	82	71	14	53	217	68	56	231	73	80
TOTAL NUMBER OF CAPTURES		185			320			138			341			384	
NUMBER OF SPECIES	19	9	8	29	7	11	19	9	11	32	11	9	26	9	15
TOTAL NUMBER OF SPECIES		24			33			28			38			30	

Table 3a. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the five coastal reserve MAPS stations operated on the Nature Reserve of Orange County in 2002.

	Little Sycamore Canyon (core)			Emerald Canyon (core)			Upper Laurel Canyon (road-edge)			Upper Wood Canyon (housing)			Sycamore Hills (housing)		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Acorn Woodpecker				1.1	0.0	0.00									
Nuttall's Woodpecker	1.0	0.0	0.00				2.0	0.0	0.00				1.1	0.0	0.00
Northern Flicker															
Western Wood-Pewee										1.0	0.0	0.00			
"Western" Flycatcher	7.2	0.0	0.00	2.2	1.1	0.33	13.0	1.0	0.07	2.0	0.0	0.00	10.6	1.1	0.09
Ash-throated Flycatcher	3.1	0.0	0.00	4.5	0.0	0.00	5.0	0.0	0.00	2.0	0.0	0.00	2.1	0.0	0.00
Cassin's Kingbird							2.0	0.0	0.00						
Hutton's Vireo				3.4	0.0	0.00	1.0	0.0	0.00	2.0	0.0	0.00			
Western Scrub-Jay	2.1	0.0	0.00										1.1	0.0	0.00
Cliff Swallow				1.1	0.0	0.00	1.0	0.0	0.00						
Oak Titmouse													1.1	0.0	0.00
Bushtit				17.9	0.0	0.00	39.0	0.0	0.00	25.1	0.0	0.00	54.1	0.0	0.00
White-breasted Nuthatch															
Cactus Wren															
Bewick's Wren	4.1	0.0	0.00	4.5	0.0	0.00	3.0	0.0	0.00	5.0	0.0	0.00	4.2	0.0	0.00
House Wren				1.1	0.0	0.00	1.0	0.0	0.00	2.0	0.0	0.00	1.1	0.0	0.00
Blue-gray Gnatcatcher	2.1	0.0	0.00												
California Gnatcatcher							1.0	0.0	0.00				1.1	0.0	0.00
Wrentit	19.5	2.1	0.09	57.0	2.2	0.04	37.0	0.0	0.00	60.3	2.0	0.03	36.0	0.0	0.00
Northern Mockingbird															
California Thrasher	3.1	0.0	0.00	4.5	0.0	0.00	6.0	0.0	0.00	1.0	0.0	0.00	1.1	0.0	0.00
Phainopepla				6.7	0.0	0.00	1.0	0.0	0.00	1.0	0.0	0.00			
Orange-crowned Warbler	1.0	0.0	0.00	3.4	0.0	0.00	6.0	0.0	0.00	3.0	0.0	0.00	10.6	0.0	0.00
Yellow Warbler				1.1	0.0	0.00	2.0	0.0	0.00	2.0	0.0	0.00	8.5	0.0	0.00
Common Yellowthroat	6.1	0.0	0.00	17.9	0.0	0.00	13.0	0.0	0.00	8.0	0.0	0.00			
Yellow-breasted Chat							1.0	0.0	0.00						
Spotted Towhee	10.3	0.0	0.00	25.7	0.0	0.00	7.0	0.0	0.00	13.1	0.0	0.00	9.5	0.0	0.00

Table 3a. (cont.) Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the five coastal reserve MAPS stations operated on the Nature Reserve of Orange County in 2002.

	Little Sycamore Canyon (core)			Emerald Canyon (core)			Upper Laurel Canyon (road-edge)			Upper Wood Canyon (housing)			Sycamore Hills (housing)		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
California Towhee	1.0	0.0	0.00	6.7	0.0	0.00	15.0	0.0	0.00	2.0	0.0	0.00	1.1	0.0	0.00
Rufous-crowned Sparrow	2.1	0.0	0.00										1.1	0.0	0.00
Black-chinned Sparrow															
Grasshopper Sparrow							1.0	0.0	0.00						
Song Sparrow	2.1	0.0	0.00	7.8	0.0	0.00	6.0	0.0	0.00	4.0	0.0	0.00			
Black-headed Grosbeak				5.6	0.0	0.00				1.0	0.0	0.00	1.1	0.0	0.00
Blue Grosbeak							4.0	0.0	0.00						
Lazuli Bunting										2.0	0.0	0.00	1.1	0.0	0.00
Hooded Oriole													1.1	0.0	0.00
Bullock's Oriole													2.1	0.0	0.00
House Finch										9.0	6.0	0.40	8.5	2.1	0.20
Lesser Goldfinch				2.2	0.0	0.00	2.0	0.0	0.00				4.2	0.0	0.00
ALL SPECIES POOLED	64.6	2.1	0.03	174.4	3.4	0.02	169.0	1.0	0.01	145.8	8.0	0.05	162.2	3.2	0.02
NUMBER OF SPECIES	14	1		19	2		23	1		19	2		22	2	
TOTAL NUMBER OF SPECIES		14			19			23			19			22	

Table 3b. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the five central reserve MAPS stations operated on the Nature Reserve of Orange County in 2002.

	Weir Canyon (core)			Round Canyon (core)			Irvine Park (road-edge)			Upper Weir Canyon (housing)			Whiting Ranch (housing)		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Acorn Woodpecker							3.2	0.0	0.00						
Nuttall's Woodpecker	3.4	0.0	0.00	3.0	0.0	0.00	1.1	0.0	0.00	1.0	0.0	0.00	1.0	0.0	0.00
Northern Flicker							1.1	0.0	0.00						
Western Wood-Pewee															
"Western" Flycatcher	13.8	0.0	0.00	10.1	1.0	0.09	4.3	0.0	0.00	15.5	0.0	0.00	6.2	1.0	0.14
Ash-throated Flycatcher	4.6	0.0	0.00	1.0	0.0	0.00	5.4	0.0	0.00	4.1	0.0	0.00	7.2	0.0	0.00
Cassin's Kingbird															
Hutton's Vireo	1.1	1.1	0.50												
Western Scrub-Jay				2.0	0.0	0.00	2.2	0.0	0.00	1.0	1.0	0.50	3.1	0.0	0.00
Cliff Swallow															
Oak Titmouse				7.1	0.0	0.00	3.2	0.0	0.00	2.1	0.0	0.00	3.1	0.0	0.00
Bushtit	5.7	0.0	0.00	27.3	0.0	0.00	9.7	0.0	0.00	39.3	0.0	0.00	20.7	0.0	0.00
White-breasted Nuthatch							1.1	0.0	0.00						
Cactus Wren	1.1	0.0	0.00	1.0	0.0	0.00							6.2	0.0	0.00
Bewick's Wren	9.2	0.0	0.00	9.1	0.0	0.00	2.2	0.0	0.00	3.1	0.0	0.00	12.4	0.0	0.00
House Wren	2.3	0.0	0.00	7.1	0.0	0.00	2.2	0.0	0.00	2.1	1.0	0.33	1.0	0.0	0.00
Blue-gray Gnatcatcher	1.1	0.0	0.00												
California Gnatcatcher				1.0	0.0	0.00							1.0	1.0	0.50
Wrentit	42.5	0.0	0.00	84.9	5.1	0.06	22.6	0.0	0.00	37.2	2.1	0.05	79.7	3.1	0.04
Northern Mockingbird				1.0	0.0	0.00				1.0	0.0	0.00	1.0	0.0	0.00
California Thrasher	4.6	0.0	0.00	8.1	0.0	0.00	2.2	0.0	0.00	6.2	0.0	0.00	7.2	0.0	0.00
Phainopepla										2.1	0.0	0.00			
Orange-crowned Warbler				6.1	0.0	0.00				2.1	0.0	0.00	2.1	0.0	0.00
Yellow Warbler										1.0	0.0	0.00			
Common Yellowthroat				1.0	0.0	0.00				1.0	0.0	0.00	3.1	0.0	0.00
Yellow-breasted Chat													1.0	0.0	0.00
Spotted Towhee	18.4	0.0	0.00	19.2	0.0	0.00	7.5	0.0	0.00	22.7	0.0	0.00	38.3	0.0	0.00

Table 3b. (cont.) Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the five central reserve MAPS stations operated on the Nature Reserve of Orange County in 2002.

	Weir Canyon (core)			Round Canyon (core)			Irvine Park (road-edge)			Upper Weir Canyon (housing)			Whiting Ranch (housing)		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
California Towhee	29.8	0.0	0.00	10.1	0.0	0.00	7.5	0.0	0.00	9.3	0.0	0.00	10.3	0.0	0.00
Rufous-crowned Sparrow				2.0	0.0	0.00	4.3	0.0	0.00	3.1	0.0	0.00	1.0	1.0	0.50
Black-chinned Sparrow										1.0	0.0	0.00			
Grasshopper Sparrow															
Song Sparrow				3.0	0.0	0.00				2.1	0.0	0.00	8.3	2.1	0.20
Black-headed Grosbeak				3.0	0.0	0.00				1.0	0.0	0.00			
Blue Grosbeak							2.2	0.0	0.00						
Lazuli Bunting							1.1	0.0	0.00	2.1	0.0	0.00			
Hooded Oriole															
Bullock's Oriole															
House Finch				4.0	0.0	0.00				10.3	12.4	0.54	9.3	5.2	0.36
Lesser Goldfinch				1.0	0.0	0.00				5.2	0.0	0.00	5.2	1.0	0.17
ALL SPECIES POOLED	137.8	1.1	0.01	212.4	6.1	0.03	82.9	0.0	0.00	175.8	16.5	0.09	228.6	14.5	0.06
NUMBER OF SPECIES	13	1		22	2		18	0		24	4		22	7	
TOTAL NUMBER OF SPECIES		13			22			18			24			22	

Table 4. Summary of results for all ten Nature Reserve of Orange County MAPS stations combined in 2002.

Species	Birds captured			Birds/600net-hours		Prop. Young
	Newly banded	Un-banded	Recap-tured	Adults	Young	
California Quail		1				
Mourning Dove		2				
Black-chinned Hummingbird		34				
Anna's Hummingbird		246				
Costa's Hummingbird		86				
Calliope Hummingbird		12				
Rufous Hummingbird		4				
Allen's Hummingbird		46				
Unidentified Selasphorus		20				
Unidentified Hummingbird		12				
Acorn Woodpecker	2		2	0.4	0.0	0.00
Nuttall's Woodpecker	10		3	1.4	0.0	0.00
Northern Flicker	1			0.1	0.0	0.00
Western Wood-Pewee	1			0.1	0.0	0.00
"Traill's" Flycatcher	9	1	1			
Hammond's Flycatcher	1					
"Western" Flycatcher	84	1	5	8.5	0.5	0.06
Black Phoebe		1				
Ash-throated Flycatcher	36		1	3.9	0.0	0.00
Cassin's Kingbird	2			0.2	0.0	0.00
Hutton's Vireo	5		5	0.7	0.1	0.13
Warbling Vireo	82	1	3			
Western Scrub-Jay	12	1	1	1.2	0.1	0.08
Cliff Swallow	2			0.2	0.0	0.00
Oak Titmouse	12		8	1.7	0.0	0.00
Bushtit	191	9	77	24.1	0.0	0.00
White-breasted Nuthatch	1			0.1	0.0	0.00
Cactus Wren	6		2	0.8	0.0	0.00
Bewick's Wren	34		34	5.7	0.0	0.00
House Wren	18	2	10	2.0	0.1	0.05
Blue-gray Gnatcatcher	2		3	0.3	0.0	0.00
California Gnatcatcher	5	1		0.4	0.1	0.20
Swainson's Thrush	120	1	14			
Hermit Thrush	2					
Wrentit	338	14	301	47.6	1.7	0.03
Northern Mockingbird	3			0.3	0.0	0.00
California Thrasher	34	3	12	4.4	0.0	0.00
Phainopepla	10	1		1.0	0.0	0.00
Orange-crowned Warbler	31		4	3.5	0.0	0.00
Nashville Warbler	1		1			
Yellow Warbler	14			1.5	0.0	0.00

Table 4. (cont.) Summary of results for all ten Nature Reserve of Orange County MAPS stations combined in 2002.

Species	Birds captured			Birds/600net-hours		
	Newly banded	Un-banded	Recap-tured	Adults	Young	Prop. Young
Black-throated Gray Warbler	5		1			
Townsend's Warbler	24		3			
Hermit Warbler	12	1				
MacGillivray's Warbler	7		1			
Common Yellowthroat	41	4	20	5.0	0.0	0.00
Wilson's Warbler	101	1	7			
Yellow-breasted Chat	2			0.2	0.0	0.00
Western Tanager	10		1			
Spotted Towhee	139	5	44	17.1	0.0	0.00
California Towhee	72	6	20	9.1	0.0	0.00
Rufous-crowned Sparrow	12	3	4	1.4	0.1	0.07
Black-chinned Sparrow	1			0.1	0.0	0.00
Grasshopper Sparrow	1			0.1	0.0	0.00
Song Sparrow	23		19	3.4	0.2	0.06
Lincoln's Sparrow	1					
Golden-crowned Sparrow	1					
Black-headed Grosbeak	11		2	1.2	0.0	0.00
Blue Grosbeak	5		1	0.6	0.0	0.00
Lazuli Bunting	6			0.6	0.0	0.00
Hooded Oriole	1			0.1	0.0	0.00
Bullock's Oriole	2			0.2	0.0	0.00
House Finch	65		2	4.2	2.6	0.39
Lesser Goldfinch	19		1	2.0	0.1	0.05
ALL SPECIES POOLED	1630	519	613	155.5	5.7	0.04
TOTAL NUMBER OF CAPTURES		2762				
NUMBER OF SPECIES	53	26	33	39	10	
TOTAL NUMBER OF SPECIES		62			39	

Table 5a. Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at the five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined			
						n[1]	No. adults 2001	No. adults 2002	% change	SE[2]
Acorn Woodpecker		++++[3]				1	0	1	++++[3]	
Nuttall's Woodpecker	0.0		++++[3]		++++[3]	3	1	4	+300.0	458.3
Northern Flicker						1	0	1	++++	
Western Wood-Pewee				++++[3]	-100.0	2	1	1	0.0	200.0
"Western" Flycatcher	+75.0	+100.0	++++	-60.0	+66.7	5	16	31	+93.8	89.0
Black Phoebe					-100.0	1	1	0	-100.0	
Say's Phoebe						0	0	0		
Ash-throated Flycatcher	-50.0	+100.0	-28.6	++++	-33.3	5	18	16	-11.1	25.1
Cassin's Kingbird			-60.0			1	5	2	-60.0	
Western Kingbird						0	0	0		
Hutton's Vireo	-100.0	++++	0.0	+100.0		4	3	6	+100.0	144.0
Western Scrub-Jay	+100.0				-50.0	2	3	3	0.0	66.7
Northern Rough-winged Swallow			-100.0			1	1	0	-100.0	
Cliff Swallow		++++	++++	-100.0		3	3	2	-33.3	100.0
Oak Titmouse					++++	1	0	1	++++	
Bushtit	-100.0	+100.0	+290.0	+122.2	+41.7	5	70	126	+80.0	45.4
White-breasted Nuthatch						1	0	1	++++	
Cactus Wren						3	4	8	+100.0	43.3
Canyon Wren						0	0	0		
Bewick's Wren	-33.3	+100.0	+100.0	++++	-55.6	5	18	19	+5.6	50.1
House Wren	-100.0	0.0	0.0	++++	0.0	5	4	5	+25.0	67.0
Blue-gray Gnatcatcher	-33.3					1	3	2	-33.3	
California Gnatcatcher			0.0		++++	2	1	2	+100.0	200.0
Wrentit	0.0	+112.5	+89.5	+89.7	-21.4	5	133	194	+45.9	31.0
Northern Mockingbird						0	0	0		
California Thrasher	+50.0	+300.0	+20.0	0.0	0.0	5	10	15	+50.0	33.5

Table 5a. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined			
						n[1]	No. adults 2001	No. adults 2002	% change	SE[2]
Phainopepla		++++		++++		2	0	6	++++	
Orange-crowned Warbler	-90.0	-80.0	+100.0	-66.7	+900.0	5	38	23	-39.5	38.8
Yellow Warbler	-100.0	0.0	0.0	+100.0	+33.3	5	13	13	0.0	32.2
Common Yellowthroat	+500.0	-17.6	-13.3	+100.0		4	37	41	+10.8	26.7
Yellow-breasted Chat			-75.0			1	4	1	-75.0	
Spotted Towhee	-9.1	+50.0	-65.0	+62.5	+12.5	5	61	60	-1.6	28.5
California Towhee	-80.0	-50.0	-21.1	0.0	-75.0	5	42	25	-40.5	12.3**
Rufous-crowned Sparrow	-60.0	-100.0			0.0	3	9	3	-66.7	17.0*
Black-chinned Sparrow						1	0	1	++++	
Grasshopper Sparrow			++++			1	0	1	++++	
Song Sparrow	++++[3]	-25.0	+20.0	+100.0		4	15	18	+20.0	34.0
Black-headed Grosbeak	-100.0	++++	-100.0	++++	++++	5	3	7	+133.3	274.4
Blue Grosbeak			+300.0			1	1	4	+300.0	
Lazuli Bunting				++++	++++	2	0	3	++++	
Hooded Oriole					0.0	1	1	1	0.0	
Bullock's Oriole	-100.0	-100.0	-100.0		+100.0	4	12	2	-83.3	22.1**
Purple Finch						1	1	0	-100.0	
House Finch	-100.0	-100.0	-100.0	+200.0	+100.0	5	13	17	+30.8	68.9
Lesser Goldfinch	-100.0	++++	-33.3	-100.0	-42.9	5	14	8	-42.9	21.6***
House Sparrow						1	2	0	-100.0	
ALL SPECIES POOLED	-32.3	+33.9	+21.6	+68.8	+12.6	5	554	663	+19.7	13.1

Table 5a. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined
No. species that increased[4]	5(1)	13(6)	11(4)	15(7)	12(5)	23(8)
No. species that decreased[5]	15(8)	7(3)	11(4)	4(2)	8(2)	15(4)
No. species remained same	2	2	4	2	4	4
TOTAL NUMBER OF SPECIES	22	22	26	21	24	42
Proportion of increasing (decreasing) species	(0.682)	0.591	0.423	0.714	0.500	0.548
Sig. of increase (decrease)[6]	(0.067) *	0.262	0.837	0.039 **	0.581	0.322

[1] Number of stations at which at least one adult bird was captured in either year.
[2] Standard error of the % change in the number of adult birds captured.
[3] Increase indeterminate (infinite) because no adult was captured during 2001.
[4] No. of species for which adults were captured in 2002 but not in 2001 are in parentheses.
[5] No. of species for which adults were captured in 2001 but not in 2002 are in parentheses.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$.

Table 5b. Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	All five central reserve stations combined				
						n[1]	No. adults 2001	No. adults 2002	% change	SE[2]
Acorn Woodpecker			-40.0			1	5	3	-40.0	
Nuttall's Woodpecker	+50.0	0.0	0.0	++++ [3]	++++ [3]	5	6	9	+50.0	39.5
Northern Flicker			++++[3]			1	0	1	++++[3]	
Western Wood-Pewee		-100.0				1	1	0	-100.0	
"Western" Flycatcher	+140.0	+400.0	+200.0	+200.0	+200.0	5	14	43	+207.1	40.9***
Black Phoebe					-100.0	1	1	0	-100.0	
Say's Phoebe						0	0	0		
Ash-throated Flycatcher	+33.3	-75.0	0.0	0.0	+600.0	5	15	19	+26.7	53.3
Cassin's Kingbird						1	5	2	-60.0	
Western Kingbird						0	0	0		
Hutton's Vireo	0.0				-100.0	2	2	1	-50.0	50.0
Western Scrub-Jay		-60.0	++++	-50.0	+50.0	4	9	7	-22.2	33.9
Northern Rough-winged Swallow						1	1	0	-100.0	
Cliff Swallow						3	3	2	-33.3	100.0
Oak Titmouse	-100.0	+75.0	+50.0	++++	0.0	5	12	14	+16.7	41.0
Bushtit	0.0	+350.0	-10.0	+125.0	+185.7	5	44	97	+120.5	51.9*
White-breasted Nuthatch			++++			1	0	1	++++	
Cactus Wren	0.0	++++ [3]			+100.0	3	4	8	+100.0	43.3
Canyon Wren						0	0	0		
Bewick's Wren	-11.1	0.0	-50.0	-40.0	+71.4	5	34	34	0.0	19.2
House Wren	-50.0	+40.0	0.0	-33.3	-66.7	5	17	14	-17.6	23.2
Blue-gray Gnatcatcher	0.0					1	1	1	0.0	
California Gnatcatcher		++++			++++	2	0	2	++++	
Wrentit	+42.3	+228.0	+31.3	+88.2	+140.6	5	116	249	+114.7	36.4**
Northern Mockingbird		++++		-66.7	0.0	3	4	3	-25.0	49.6
California Thrasher	++++ [3]	+300.0	++++	+200.0	+75.0	5	8	27	+237.5	112.1**

Table 5b. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	n[1]	All five central reserve stations combined: No. adults 2001	No. adults 2002	% change	SE[2]
Phainopepla	-100.0		-100.0	++++	-100.0	4	5	2	-60.0	53.9
Orange-crowned Warbler		+100.0	-100.0	++++	0.0	4	9	10	+11.1	71.3
Yellow Warbler	-100.0	-100.0		-100.0		3	6	0	-100.0	
Common Yellowthroat		-50.0	-100.0	-100.0	+200.0	4	9	4	-55.6	43.8
Yellow-breasted Chat					++++	1	0	1	++++	
Spotted Towhee	+300.0	+18.8	-30.0	+340.0	+236.4	5	46	101	+119.6	69.7
California Towhee	+160.0	+42.9	-50.0	+75.0	0.0	5	45	60	+33.3	43.8
Rufous-crowned Sparrow	-100.0	++++	0.0	+50.0	++++	5	9	10	+11.1	51.1
Black-chinned Sparrow				++++		1	0	1	++++	
Grasshopper Sparrow						1	0	1	++++	
Song Sparrow		+50.0		-33.3	-27.3	3	16	13	-18.8	13.2
Black-headed Grosbeak		++++		-66.7		2	3	4	+33.3	200.0
Blue Grosbeak			++++		-100.0	2	2	1	-50.0	100.0
Lazuli Bunting	-100.0	-100.0	-50.0	++++		4	6	3	-50.0	47.1
Hooded Oriole				-100.0	-100.0	2	3	0	-100.0	0.0
Bullock's Oriole						4	12	2	-83.3	22.1**
Purple Finch					-100.0	1	1	0	-100.0	
House Finch	-100.0	-66.7		0.0	+80.0	4	20	20	0.0	28.3
Lesser Goldfinch	-100.0	-88.9	-100.0	-61.5	-58.3	5	44	11	-75.0	9.1***
House Sparrow					-100.0	1	2	0	-100.0	
ALL SPECIES POOLED	+27.7	+84.7	-12.0	+49.0	+74.0	5	519	774	+49.1	16.0**

Table 5b. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	All five central reserve stations combined
No. species that increased[4]	7(1)	15(5)	8(5)	13(6)	15(4)	19(6)
No. species that decreased[5]	9(7)	8(3)	10(4)	10(3)	10(7)	21(7)
No. species remained same	4	2	4	2	4	3
TOTAL NUMBER OF SPECIES	20	25	22	25	29	43
Proportion of increasing (decreasing) species	0.350	0.600	(0.455)	0.520	0.517	0.442
Sig. of increase (decrease)[6]	0.942	0.212	(0.738)	0.500	0.500	0.820

[1] Number of stations at which at least one adult bird was captured in either year.
[2] Standard error of the % change in the number of adult birds captured.
[3] Increase indeterminate (infinite) because no adult was captured during 2001.
[4] No. of species for which adults were captured in 2002 but not in 2001 are in parentheses.
[5] No. of species for which adults were captured in 2001 but not in 2002 are in parentheses.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$.

Table 5c. Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured over all ten MAPS stations on the Nature Reserve of Orange County combined.

Species	n[1]	No. adults 2001	No. adults 2002	% change	SE[2]
Acorn Woodpecker	2	5	4	-20.0	40.0
Nuttall's Woodpecker	8	7	13	85.7	60.3
Northern Flicker	1	0	1	++++ [3]	
Western Wood-Pewee	3	2	1	-50.0	75.0
"Western" Flycatcher	10	30	74	146.7	57.7**
Black Phoebe	2	2	0	-100.0	0.0
Say's Phoebe	0	0	0		
Ash-throated Flycatcher	10	33	35	6.1	27.2
Cassin's Kingbird	1	5	2	-60.0	
Western Kingbird	0	0	0		
Hutton's Vireo	6	5	7	40.0	80.8
Western Scrub-Jay	6	12	10	-16.7	28.5
Northern Rough-winged Swa	1	1	0	-100.0	
Cliff Swallow	3	3	2	-33.3	100.0
Oak Titmouse	6	12	15	25.0	41.7
Bushtit	10	114	223	95.6	34.3**
White-breasted Nuthatch	1	0	1	++++	
Cactus Wren	3	4	8	100.0	43.3
Canyon Wren	0	0	0		
Bewick's Wren	10	52	53	1.9	19.7
House Wren	10	21	19	-9.5	20.7
Blue-gray Gnatcatcher	2	4	3	-25.0	12.5
California Gnatcatcher	4	1	4	300.0	400.0
Wrentit	10	249	443	77.9	26.8***
Northern Mockingbird	3	4	3	-25.0	49.6
California Thrasher	10	18	42	133.3	52.2**
Phainopepla	6	5	8	60.0	159.6
Orange-crowned Warbler	9	47	33	-29.8	34.4
Yellow Warbler	8	19	13	-31.6	29.9
Common Yellowthroat	8	46	45	-2.2	21.0
Yellow-breasted Chat	2	4	2	-50.0	50.0
Spotted Towhee	10	107	161	50.5	36.9
California Towhee	10	87	85	-2.3	24.1
Rufous-crowned Sparrow	8	18	13	-27.8	27.0
Black-chinned Sparrow	1	0	1	++++	
Grasshopper Sparrow	1	0	1	++++	
Song Sparrow	7	31	31	0.0	17.1
Black-headed Grosbeak	7	6	11	83.3	153.9
Blue Grosbeak	3	3	5	66.7	171.1
Lazuli Bunting	6	6	6	0.0	77.5
Hooded Oriole	3	4	1	-75.0	28.6
Bullock's Oriole	4	12	2	-83.3	22.1**

Table 5c. (cont) Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured over all ten MAPS stations on the Nature Reserve of Orange County combined.

Species	n[1]	No. adults 2001	No. adults 2002	% change	SE[2]	
Purple Finch	1	1	0	-100.0		
House Finch	9	33	37	12.1	30.6	
Lesser Goldfinch	10	58	19	-67.2	8.5	***
House Sparrow	1	2	0	-100.0		
ALL SPECIES POOLED	10	1073	1437	33.9	11.3	***

No. species that increased[4]	20 (4)
No. species that decreased[5]	21 (4)
No. species remained same	2
TOTAL NUMBER OF SPECIES	43
Proportion of increasing (decreasing) species	0.465
Sig. of increase (decrease)[6]	0.729

[1] Number of stations at which at least one adult bird was captured in either year.
[2] Standard error of the % change in the number of adult birds captured.
[3] Increase indeterminate (infinite) because no adult was captured during 2001.
[4] No. of species for which adults were captured in 2002 but not in 2001 are in parentheses.
[5] No. of species for which adults were captured in 2001 but not in 2002 are in parentheses.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$.

Table 6a. Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined			
						n[1]	No. young 2001	No. young 2002	% change	SE[2]
Acorn Woodpecker						0	0	0		
Nuttall's Woodpecker	-100.0			-100.0	-100.0	3	3	0	-100.0	0.0***
Northern Flicker						0	0	0		
Western Wood-Pewee						0	0	0		
"Western" Flycatcher		++++[3]	++++ [3]		++++ [3]	3	0	3	++++[3]	
Black Phoebe	-100.0		-100.0			2	2	0	-100.0	0.0
Say's Phoebe						1	1	0	-100.0	
Ash-throated Flycatcher						0	0	0		
Cassin's Kingbird			-100.0			1	4	0	-100.0	
Western Kingbird			-100.0			1	1	0	-100.0	
Hutton's Vireo			-100.0	-100.0		2	2	0	-100.0	0.0
Western Scrub-Jay	-100.0		-100.0	-100.0		3	5	0	-100.0	0.0***
Northern Rough-winged Swallow				-100.0		1	1	0	-100.0	
Cliff Swallow						0	0	0		
Oak Titmouse						0	0	0		
Bushtit	-100.0	-100.0	-100.0	-100.0	-100.0	5	29	0	-100.0	0.0***
White-breasted Nuthatch						0	0	0		
Cactus Wren						2	5	0	-100.0	0.0
Canyon Wren						1	1	0	-100.0	
Bewick's Wren	-100.0	-100.0	-100.0	-100.0	-100.0	5	34	0	-100.0	0.0***
House Wren	-100.0	-100.0	-100.0		-100.0	4	13	0	-100.0	0.0***
Blue-gray Gnatcatcher	-100.0					1	4	0	-100.0	
California Gnatcatcher		-100.0			-100.0	2	2	0	-100.0	0.0
Wrentit	-92.6	-93.1	-100.0	-95.7	-100.0	5	153	6	-96.1	1.4***
Northern Mockingbird		-100.0				1	1	0	-100.0	
California Thrasher	-100.0	-100.0	-100.0	-100.0	-100.0	5	26	0	-100.0	0.0***

Table 6a. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined			
						n[1]	No. young 2001	No. young 2002	% change	SE[2]
Phainopepla						0	0	0		
Orange-crowned Warbler	-100.0	-100.0		-100.0	-100.0	4	58	0	-100.0	0.0***
Yellow Warbler						0	0	0		
Common Yellowthroat	-100.0	-100.0	-100.0	-100.0	-100.0	5	54	0	-100.0	0.0***
Yellow-breasted Chat						0	0	0		
Spotted Towhee	-100.0	-100.0	-100.0	-100.0	-100.0	5	35	0	-100.0	0.0***
California Towhee	-100.0	-100.0	-100.0	-100.0	-100.0	5	19	0	-100.0	0.0***
Rufous-crowned Sparrow	-100.0		-100.0	-100.0		3	13	0	-100.0	0.0***
Black-chinned Sparrow						0	0	0		
Grasshopper Sparrow						0	0	0		
Song Sparrow		-100.0	-100.0	-100.0	-100.0	4	27	0	-100.0	0.0***
Black-headed Grosbeak						0	0	0		
Blue Grosbeak			-100.0	-100.0		2	2	0	-100.0	0.0
Lazuli Bunting						0	0	0		
Hooded Oriole				-100.0		1	1	0	-100.0	
Bullock's Oriole			-100.0			1	2	0	-100.0	
Purple Finch						0	0	0		
House Finch	-100.0		-100.0	+200.0	-50.0	4	9	8	-11.1	63.1
Lesser Goldfinch		-100.0	-100.0		-100.0	3	7	0	-100.0	0.0***
House Sparrow						0	0	0		
ALL SPECIES POOLED	-98.2	-96.3	-99.1	-92.1	-97.0	5	507	17	-96.6	1.3***

Table 6a. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined
No. species that increased[4]	0(0)	1(1)	1(1)	1(0)	1(1)	1(1)
No. species that decreased[5]	15(14)	13(12)	19(19)	16(15)	14(13)	29(27)
No. species remained same	0	0	0	0	0	0
TOTAL NUMBER OF SPECIES	15	14	20	17	15	30
Proportion of increasing (decreasing) species	(1.000)	(0.933)	(0.950)	(0.941)	(0.933)	(0.967)
Sig. of increase (decrease)[6]	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***

[1] Number of stations at which at least one young bird was captured in either year.
[2] Standard error of the % change in the number of young birds captured.
[3] Increase indeterminate (infinite) because no young was captured during 2001.
[4] No. of species for which young were captured in 2002 but not in 2001 are in parentheses.
[5] No. of species for which young were captured in 2001 but not in 2002 are in parentheses.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$.

Table 6b. Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	All five central reserve stations combined				
						n[1]	No. young 2001	No. young 2002	% change	SE[2]
Acorn Woodpecker						0	0	0		
Nuttall's Woodpecker	-100.0	-100.0	-100.0	-100.0		4	4	0	-100.0	0.0***
Northern Flicker						0	0	0		
Western Wood-Pewee						0	0	0		
"Western" Flycatcher		++++[3]			++++[3]	2	0	2	++++[3]	
Black Phoebe				-100.0		1	3	0	-100.0	
Say's Phoebe				-100.0		1	1	0	-100.0	
Ash-throated Flycatcher		-100.0		-100.0		2	3	0	-100.0	0.0
Cassin's Kingbird						1	4	0	-100.0	
Western Kingbird						1	1	0	-100.0	
Hutton's Vireo	++++[3]				-100.0	2	2	1	-50.0	100.0
Western Scrub-Jay				-75.0		1	4	1	-75.0	
Northern Rough-winged Swallow						1	1	0	-100.0	
Cliff Swallow						0	0	0		
Oak Titmouse	-100.0	-100.0	-100.0	-100.0	-100.0	5	8	0	-100.0	0.0***
Bushtit	-100.0	-100.0	-100.0	-100.0	-100.0	5	23	0	-100.0	0.0***
White-breasted Nuthatch						0	0	0		
Cactus Wren		-100.0			-100.0	2	5	0	-100.0	0.0
Canyon Wren		-100.0				1	1	0	-100.0	
Bewick's Wren	-100.0	-100.0	-100.0	-100.0	-100.0	5	54	0	-100.0	0.0***
House Wren	-100.0	-100.0	-100.0	-87.5	-100.0	5	28	1	-96.4	3.3***
Blue-gray Gnatcatcher	-100.0					1	5	0	-100.0	
California Gnatcatcher	-100.0	-100.0			++++	3	2	1	-50.0	75.0
Wrentit	-100.0	-68.8	-100.0	-87.5	-86.4	5	103	10	-90.3	5.4***
Northern Mockingbird	-100.0			-100.0		2	2	0	-100.0	0.0
California Thrasher	-100.0	-100.0	-100.0	-100.0	-100.0	5	10	0	-100.0	0.0***

Table 6b. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	All five central reserve stations combined			
						n[1]	No. young 2001	No. young 2002	% change	SE[2]
Phainopepla						0	0	0		
Orange-crowned Warbler		-100.0		-100.0		2	3	0	-100.0	0.0
Yellow Warbler						0	0	0		
Common Yellowthroat		-100.0	-100.0	-100.0	-100.0	4	16	0	-100.0	0.0***
Yellow-breasted Chat						0	0	0		
Spotted Towhee	-100.0	-100.0	-100.0	-100.0	-100.0	5	76	0	-100.0	0.0***
California Towhee	-100.0	-100.0	-100.0	-100.0	-100.0	5	41	0	-100.0	0.0***
Rufous-crowned Sparrow	-100.0	-100.0	-100.0	-100.0	-50.0	5	29	1	-96.6	4.4***
Black-chinned Sparrow						0	0	0		
Grasshopper Sparrow						0	0	0		
Song Sparrow		-100.0	-100.0	-100.0	-71.4	4	16	2	-87.5	9.7***
Black-headed Grosbeak		-100.0	-100.0	-100.0	-100.0	4	8	0	-100.0	0.0***
Blue Grosbeak	-100.0				-100.0	2	3	0	-100.0	0.0
Lazuli Bunting	-100.0					1	1	0	-100.0	
Hooded Oriole						0	0	0		
Bullock's Oriole						1	2	0	-100.0	
Purple Finch						0	0	0		
House Finch	-100.0	-100.0		50.0	66.7	4	15	17	13.3	35.6
Lesser Goldfinch	-100.0	-100.0		-100.0	-75.0	4	10	1	-90.0	8.2***
House Sparrow						0	0	0		
ALL SPECIES POOLED	-98.9	-93.5	-100.0	-85.0	-87.8	5	476	37	-92.2	2.9***

Table 6b. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	All five central reserve stations combined
No. species that increased[4]	1(1)	1(1)	0(0)	1(0)	3(2)	2(1)
No. species that decreased[5]	17(17)	20(19)	13(13)	20(17)	16(12)	31(23)
No. species remained same	0	0	0	0	0	0
TOTAL NUMBER OF SPECIES	18	21	13	21	19	33
Proportion of increasing (decreasing) species	(0.944)	(0.952)	(1.000)	(0.952)	(0.842)	(0.939)
Sig. of increase (decrease)[6]	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***

[1] Number of stations at which at least one young bird was captured in either year.
[2] Standard error of the % change in the number of young birds captured.
[3] Increase indeterminate (infinite) because no young was captured during 2001.
[4] No. of species for which young were captured in 2002 but not in 2001 are in parentheses.
[5] No. of species for which young were captured in 2001 but not in 2002 are in parentheses.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$.

Table 6c. Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured over all ten MAPS stations on the Nature Reserve of Orange County combined.

Species	n[1]	No. young 2001	No. young 2002	% change	SE[2]
Acorn Woodpecker	0	0	0		
Nuttall's Woodpecker	7	7	0	-100.0	0.0***
Northern Flicker	0	0	0		
Western Wood-Pewee	0	0	0		
"Western" Flycatcher	5	0	5	++++[3]	
Black Phoebe	3	5	0	-100.0	0.0***
Say's Phoebe	1	1	0	-100.0	
Ash-throated Flycatcher	2	3	0	-100.0	0.0
Cassin's Kingbird	1	4	0	-100.0	
Western Kingbird	1	1	0	-100.0	
Hutton's Vireo	4	4	1	-75.0	33.9
Western Scrub-Jay	4	9	1	-88.9	8.6***
Northern Rough-winged Swallow	1	1	0	-100.0	
Cliff Swallow	0	0	0		
Oak Titmouse	5	8	0	-100.0	0.0***
Bushtit	10	52	0	-100.0	0.0***
White-breasted Nuthatch	0	0	0		
Cactus Wren	2	5	0	-100.0	0.0
Canyon Wren	1	1	0	-100.0	
Bewick's Wren	10	88	0	-100.0	0.0***
House Wren	9	41	1	-97.6	2.3***
Blue-gray Gnatcatcher	2	9	0	-100.0	0.0
California Gnatcatcher	5	4	1	-75.0	31.3*
Wrentit	10	256	16	-93.8	2.3***
Northern Mockingbird	3	3	0	-100.0	0.0***
California Thrasher	10	36	0	-100.0	0.0***
Phainopepla	0	0	0		
Orange-crowned Warbler	6	61	0	-100.0	0.0***
Yellow Warbler	0	0	0		
Common Yellowthroat	9	70	0	-100.0	0.0***
Yellow-breasted Chat	0	0	0		
Spotted Towhee	10	111	0	-100.0	0.0***
California Towhee	10	60	0	-100.0	0.0***
Rufous-crowned Sparrow	8	42	1	-97.6	2.8***
Black-chinned Sparrow	0	0	0		
Grasshopper Sparrow	0	0	0		
Song Sparrow	8	43	2	-95.3	4.6***
Black-headed Grosbeak	4	8	0	-100.0	0.0***
Blue Grosbeak	4	5	0	-100.0	0.0***
Lazuli Bunting	1	1	0	-100.0	
Hooded Oriole	1	1	0	-100.0	
Bullock's Oriole	1	2	0	-100.0	

Table 6c. (cont) Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured over all ten MAPS stations on the Nature Reserve of Orange County combined.

Species	n[1]	No. young 2001	No. young 2002	% change	SE[2]
Purple Finch	0	0	0		
House Finch	8	24	25	+4.2	31.8
Lesser Goldfinch	7	17	1	-94.1	5.3 ***
House Sparrow	0	0	0		
ALL SPECIES POOLED	10	983	54	-94.5	1.7 ***

No. species that increased[4]	2 (1)
No. species that decreased[5]	32(24)
No. species remained same	0
TOTAL NUMBER OF SPECIES	34
Proportion of increasing (decreasing) species	(0.941)
Sig. of increase (decrease)[6]	(0.000) ***

[1] Number of stations at which at least one young bird was captured in either year.
[2] Standard error of the % change in the number of young birds captured.
[3] Increase indeterminate (infinite) because no young was captured during 2001.
[4] No. of species for which young were captured in 2002 but not in 2001 are in parentheses.
[5] No. of species for which young were captured in 2001 but not in 2002 are in parentheses.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$.

Table 7a. Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	n[1]	All five costal reserve stations combined: Prop. young 2001	Prop. young 2002	Absol. change	SE[2]
Acorn Woodpecker		+-+-+[3]				1	------[4]	0.000	+-+-+[3]	
Nuttall's Woodpecker	-0.500		+-+-+[3]	+-+-+[3]	-1.000	4	0.750	0.000	-0.750	0.177 **
Northern Flicker						1	------	0.000	+-+-+	
Western Wood-Pewee				+-+-+	+-+-+[3]	2	0.000	0.000	0.000	0.000
"Western" Flycatcher	0.000	+0.333	+-+-+	0.000	+0.091	5	0.000	0.088	+0.088	0.032 *
Black Phoebe	+-+-+[3]		+-+-+		+-+-+	3	0.667	------[4]	+-+-+	
Say's Phoebe						1	1.000	------	+-+-+	
Ash-throated Flycatcher	0.000	0.000	0.000	+-+-+	0.000	5	0.000	0.000	0.000	0.000
Cassin's Kingbird			-0.444			1	0.444	0.000	-0.444	
Western Kingbird			+-+-+			1	1.000	------	+-+-+	
Hutton's Vireo	+-+-+	+-+-+	-0.500	-0.500		4	0.400	0.000	-0.400	0.113 **
Western Scrub-Jay	-0.500		+-+-+	+-+-+	0.000	4	0.625	0.000	-0.625	0.251 *
Northern Rough-winged Swa			+-+-+	+-+-+		2	0.500	------	+-+-+	
Cliff Swallow		+-+-+	+-+-+	+-+-+		3	0.000	0.000	0.000	0.000
Oak Titmouse					+-+-+	1	------	0.000	+-+-+	
Bushtit	+-+-+	-0.429	-0.231	-0.471	-0.217	5	0.293	0.000	-0.293	0.057 ***
White-breasted Nuthatch						1	------	0.000	+-+-+	
Cactus Wren						3	0.556	0.000	-0.556	0.098 **
Canyon Wren						1	1.000	------	+-+-+	
Bewick's Wren	-0.667	-0.600	-0.800	-1.000	-0.591	5	0.654	0.000	-0.654	0.038 ***
House Wren	+-+-+	-0.875	-0.667	+-+-+	-0.750	5	0.765	0.000	-0.765	0.070 ***
Blue-gray Gnatcatcher	-0.571					1	0.571	0.000	-0.571	
California Gnatcatcher		+-+-+	0.000		-1.000	3	0.667	0.000	-0.667	0.333
Wrentit	-0.492	-0.510	-0.441	-0.583	-0.455	5	0.535	0.030	-0.505	0.040 ***
Northern Mockingbird		+-+-+				1	1.000	------	+-+-+	
California Thrasher	-0.600	-0.800	-0.688	-0.800	-0.800	5	0.722	0.000	-0.722	0.033 ***

Table 7a. (cont.) Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	n[1]	All five costal reserve stations combined: Prop. young 2001	Prop. young 2002	Absol. change	SE[2]
Phainopepla		+-+-+		+-+-+		2	------	0.000	+-+-+	
Orange-crowned Warbler	-0.796	-0.423	0.000	-0.357	-0.750	5	0.604	0.000	-0.604	0.131 ***
Yellow Warbler	+-+-+	0.000	0.000	0.000	0.000	5	0.000	0.000	0.000	0.000
Common Yellowthroat	-0.667	-0.393	-0.681	-0.636	+-+-+	5	0.593	0.000	-0.593	0.086 ***
Yellow-breasted Chat			0.000			1	0.000	0.000	0.000	
Spotted Towhee	-0.267	-0.067	-0.259	-0.529	-0.636	5	0.365	0.000	-0.365	0.100 **
California Towhee	-0.444	-0.143	-0.345	-0.333	-0.333	5	0.312	0.000	-0.312	0.052 ***
Rufous-crowned Sparrow	-0.688	+-+-+	+-+-+	+-+-+	0.000	5	0.591	0.000	-0.591	0.127 ***
Black-chinned Sparrow						1	------	0.000	+-+-+	
Grasshopper Sparrow			+-+-+			1	------	0.000	+-+-+	
Song Sparrow	+-+-+	-0.273	-0.688	-0.818	+-+-+	5	0.643	0.000	-0.643	0.127 ***
Black-headed Grosbeak	+-+-+	+-+-+	+-+-+	+-+-+	+-+-+	5	0.000	0.000	0.000	0.000
Blue Grosbeak			-0.500	+-+-+		2	0.667	0.000	-0.667	0.222
Lazuli Bunting				+-+-+	+-+-+	2	------	0.000	+-+-+	
Hooded Oriole				+-+-+	0.000	2	0.500	0.000	-0.500	0.500
Bullock's Oriole	+-+-+	+-+-+	+-+-+		0.000	4	0.143	0.000	-0.143	0.055 *
Purple Finch						1	0.000	------	+-+-+	
House Finch	+-+-+	+-+-+	+-+-+	0.000	-0.300	5	0.409	0.320	-0.089	0.109
Lesser Goldfinch	+-+-+	-1.000	-0.400	+-+-+	-0.300	5	0.333	0.000	-0.333	0.094**
House Sparrow						1	0.000	------	+-+-+	
ALL SPECIES POOLED	-0.518	-0.400	-0.451	-0.502	-0.404	5	0.478	0.025	-0.453	0.030 ***

Table 7a. (cont.) Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at five constant-effort coastal reserve MAPS stations on the Nature Reserve of Orange County.

Species	L. Syca. Canyon (core)	Emerald Canyon (core)	U. Laurel Canyon (road-edge)	U. Wood Canyon (housing)	Sycamore Hills (housing)	All five costal reserve stations combined
No. species that increased	0	1	0	0	1	1
No. species that decreased	11	11	13	10	12	23
No. species remained same	2	2	5	3	6	6
TOTAL NUMBER OF SPECIES[5]	13	14	18	13	19	30
Proportion of increasing (decreasing) species	(0.846)	(0.786)	(0.722)	(0.769)	(0.632)	(0.767)
Sig. of increase (decrease)[6]	(0.011)	(0.029)	(0.048)	(0.046)	(0.180)	(0.003)
	**	**	**	**		***

[1] Number of stations at which at least one aged bird was captured in either year.
[2] Standard error of the change in the proportion of young.
[3] The change in the proportion of young is undefined at this station because no aged individual of the species was captured in one of the two years.
[4] Proportion of young not given because no aged individual of the species was captured in the year shown.
[5] Species for which the change in the proportion of young is undefined are not included.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$

Table 7b. Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	n[1]	All five central reserve stations combined: Prop. young 2001	Prop. young 2002	Absol. change	SE[2]
Acorn Woodpecker			0.000			1	0.000	0.000	0.000	
Nuttall's Woodpecker	-0.333	-0.250	-0.500	-1.000	+-+-+ [3]	5	0.400	0.000	-0.400	0.100 **
Northern Flicker			+-+-+ [3]			1	------ [4]	0.000	+-+-+ [3]	
Western Wood-Pewee		+-+-+ [3]				1	0.000	------ [4]	+-+-+	
"Western" Flycatcher	0.000	+0.091	0.000	0.000	+0.143	5	0.000	0.044	+0.044	0.029
Black Phoebe				+-+-+[3]	+-+-+	2	0.750	------	+-+-+	
Say's Phoebe				+-+-+		1	1.000	------	+-+-+	
Ash-throated Flycatcher	0.000	-0.333	0.000	-0.250	0.000	5	0.167	0.000	-0.167	0.084
Cassin's Kingbird						1	0.444	0.000	-0.444	
Western Kingbird						1	1.000	------	+-+-+	
Hutton's Vireo	+0.500				+-+-+	2	0.500	0.500	0.000	0.250
Western Scrub-Jay		0.000	+-+-+	-0.167	0.000	4	0.308	0.125	-0.183	0.273
Northern Rough-winged Swa						2	0.500	------	+-+-+	
Cliff Swallow						3	0.000	0.000	0.000	0.000
Oak Titmouse	+-+-+ [3]	-0.200	-0.333	-1.000	-0.500	5	0.400	0.000	-0.400	0.100 **
Bushtit	-0.286	-0.143	-0.167	-0.407	-0.500	5	0.343	0.000	-0.343	0.063 ***
White-breasted Nuthatch			+-+-+			1	------	0.000	+-+-+	
Cactus Wren	0.000	-1.000			-0.571	3	0.556	0.000	-0.556	0.098 **
Canyon Wren		+-+-+				1	1.000	------	+-+-+	
Bewick's Wren	-0.625	-0.571	-0.333	-0.583	-0.720	5	0.614	0.000	-0.614	0.042 ***
House Wren	-0.692	-0.444	-0.714	-0.394	-0.400	5	0.622	0.067	-0.556	0.094 ***
Blue-gray Gnatcatcher	-0.833					1	0.833	0.000	-0.833	
California Gnatcatcher	+-+-+	-1.000			+-+-+	3	1.000	0.333	-0.667	0.192 *
Wrentit	-0.435	-0.333	-0.644	-0.426	-0.370	5	0.470	0.039	-0.432	0.049 ***
Northern Mockingbird	+-+-+	+-+-+		-0.250	0.000	4	0.333	0.000	-0.333	0.157
California Thrasher	-1.000	-0.333	-1.000	-0.600	-0.333	5	0.556	0.000	-0.556	0.122 **

Table 7b. (cont.) Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	n[1]	All five central reserve stations combined: Prop. young 2001	Prop. young 2002	Absol. change	SE[2]
Phainopepla	+-+-+		+-+-+	+-+-+	+-+-+	4	0.000	0.000	0.000	0.000
Orange-crowned Warbler		-0.250	+-+-+	-1.000	0.000	4	0.250	0.000	-0.250	0.180
Yellow Warbler	+-+-+	+-+-+		+-+-+		3	0.000	------	+-+-+	
Common Yellowthroat		-0.750	+-+-+	+-+-+	-0.800	4	0.640	0.000	-0.640	0.086 ***
Yellow-breasted Chat					+-+-+	1	------	0.000	+-+-+	
Spotted Towhee	-0.692	-0.543	-0.412	-0.722	-0.718	5	0.623	0.000	-0.623	0.057 ***
California Towhee	-0.583	-0.417	-0.263	-0.765	-0.286	5	0.477	0.000	-0.477	0.096 ***
Rufous-crowned Sparrow	+-+-+	-1.000	-0.818	-0.333	-0.500	5	0.763	0.091	-0.672	0.130 ***
Black-chinned Sparrow				+-+-+		1	------	0.000	+-+-+	
Grasshopper Sparrow						1	------	0.000	+-+-+	
Song Sparrow		-0.714	+-+-+	-0.500	-0.189	4	0.500	0.133	-0.367	0.112 **
Black-headed Grosbeak		-1.000	+-+-+	-0.400	+-+-+	4	0.727	0.000	-0.727	0.210 **
Blue Grosbeak	+-+-+		+-+-+		+-+-+	3	0.600	0.000	-0.600	0.139 **
Lazuli Bunting	+-+-+	+-+-+	0.000	+-+-+		4	0.143	0.000	-0.143	0.115
Hooded Oriole				+-+-+	+-+-+	2	0.000	------	+-+-+	
Bullock's Oriole						4	0.143	0.000	-0.143	0.055 *
Purple Finch					+-+-+	1	0.000	------	+-+-+	
House Finch	+-+-+	-0.400		+0.101	-0.018	4	0.429	0.460	+0.031	0.078
Lesser Goldfinch	+-+-+	-0.250	+-+-+	-0.133	-0.083	5	0.185	0.083	-0.102	0.070
House Sparrow					+-+-+	1	0.000	------	+-+-+	
ALL SPECIES POOLED	-0.472	-0.425	-0.475	-0.414	-0.416	5	0.478	0.046	-0.433	0.018 ***

Table 7b. (cont.) Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at five constant-effort central reserve MAPS stations on the Nature Reserve of Orange County.

Species	Weir Canyon (core)	Round Canyon (core)	Irvine Park (road-edge)	U. Weir Canyon (housing)	Whiting Ranch (housing)	All five central reserve stations combined
No. species that increased	1	1	0	1	1	2
No. species that decreased	9	19	10	17	14	25
No. species remained same	3	1	4	1	4	4
TOTAL NUMBER OF SPECIES[5]	13	21	14	19	19	31
Proportion of increasing (decreasing) species	(0.692)	(0.905)	(0.714)	(0.895)	(0.737)	(0.806)
Sig. of increase (decrease)[6]	(0.133)	(0.000) ***	(0.090) *	(0.000) ***	(0.032) **	(0.000) ***

[1] Number of stations at which at least one aged bird was captured in either year.
[2] Standard error of the change in the proportion of young.
[3] The change in the proportion of young is undefined at this station because no aged individual of the species was captured in one of the two years.
[4] Proportion of young not given because no aged individual of the species was captured in the year shown.
[5] Species for which the change in the proportion of young is undefined are not included.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$

Table 7c. Percentage changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch over all ten MAPS stations on the Nature Reserve of Orange County combined.

Species	n[1]	Prop. young 2001	Prop. young 2002	Absol. change	SE[2]
Acorn Woodpecker	2	0.000	0.000	0.000	0.000
Nuttall's Woodpecker	9	0.500	0.000	-0.500	0.107***
Northern Flicker	1	------[4]	0.000	+-+-+[3]	
Western Wood-Pewee	3	0.000	0.000	0.000	0.000
"Western" Flycatcher	10	0.000	0.063	+0.063	0.022***
Black Phoebe	5	0.714	------[4]	+-+-+	
Say's Phoebe	1	1.000	------	+-+-+	
Ash-throated Flycatcher	10	0.083	0.000	-0.083	0.055
Cassin's Kingbird	1	0.444	0.000	-0.444	
Western Kingbird	1	1.000	------	+-+-+	
Hutton's Vireo	6	0.444	0.125	-0.319	0.166
Western Scrub-Jay	8	0.429	0.091	-0.338	0.193
Northern Rough-winged Swa	2	0.500	------	+-+-+	
Cliff Swallow	3	0.000	0.000	0.000	0.000
Oak Titmouse	6	0.400	0.000	-0.400	0.098***
Bushtit	10	0.313	0.000	-0.313	0.044***
White-breasted Nuthatch	1	------	0.000	+-+-+	
Cactus Wren	3	0.556	0.000	-0.556	0.098**
Canyon Wren	1	1.000	------	+-+-+	
Bewick's Wren	10	0.629	0.000	-0.629	0.027***
House Wren	10	0.661	0.050	-0.611	0.072***
Blue-gray Gnatcatcher	2	0.692	0.000	-0.692	0.130
California Gnatcatcher	6	0.800	0.200	-0.600	0.248*
Wrentit	10	0.507	0.035	-0.472	0.031***
Northern Mockingbird	5	0.429	0.000	-0.429	0.185*
California Thrasher	10	0.667	0.000	-0.667	0.054***
Phainopepla	6	0.000	0.000	0.000	0.000
Orange-crowned Warbler	9	0.565	0.000	-0.565	0.125***
Yellow Warbler	8	0.000	0.000	0.000	0.000
Common Yellowthroat	9	0.603	0.000	-0.603	0.066***
Yellow-breasted Chat	2	0.000	0.000	0.000	0.000
Spotted Towhee	10	0.509	0.000	-0.509	0.069***
California Towhee	10	0.408	0.000	-0.408	0.065***
Rufous-crowned Sparrow	10	0.700	0.071	-0.629	0.105***
Black-chinned Sparrow	1	------	0.000	+-+-+	
Grasshopper Sparrow	1	------	0.000	+-+-+	
Song Sparrow	9	0.581	0.061	-0.521	0.100***
Black-headed Grosbeak	9	0.571	0.000	-0.571	0.180**
Blue Grosbeak	5	0.625	0.000	-0.625	0.108***
Lazuli Bunting	6	0.143	0.000	-0.143	0.110
Hooded Oriole	4	0.200	0.000	-0.200	0.217
Bullock's Oriole	4	0.143	0.000	-0.143	0.055*

Table 7c. (cont.) Percentage changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch over all ten MAPS stations on the Nature Reserve of Orange County combined.

Species	n[1]	Prop. young 2001	Prop. young 2002	Absol. change	SE[2]
Purple Finch	1	0.000	------	+-+-+	
House Finch	9	0.421	0.403	-0.018	0.072
Lesser Goldfinch	10	0.227	0.050	-0.177	0.057 ***
House Sparrow	1	0.000	------	+-+-+	0.000
ALL SPECIES POOLED	10	0.478	0.036	-0.442	0.018 ***

No. species that increased[4]	1
No. species that decreased[5]	28
No. species remained same	6
TOTAL NUMBER OF SPECIES	35
Proportion of increasing (decreasing) species	(0.800)
Sig. of increase (decrease)[6]	(0.000) ***

[1] Number of stations at which at least one aged bird was captured in either year.
[2] Standard error of the change in the proportion of young.
[3] The change in the proportion of young is undefined at this station because no aged individual of the species was captured in one of the two years.
[4] Proportion of young not given because no aged individual of the species was captured in the year shown.
[5] Species for which the change in the proportion of young is undefined are not included.
[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.
*** $P < 0.01$; ** $0.01 \leq P < 0.05$; * $0.05 \leq P < 0.10$

Table 8. Mean numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated all three years 2000-2002 on the Nature Reserve of Orange County averaged over the three years, 2000-2002. Data for each species are included only from stations that lie within the breeding range of the species.

	L.Sycamore Can.			U. Laurel Can.			U. Wood Can.			Weir Canyon			Irvine Park			U. Weir Can.			All stations pooled		
Species	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.
Mourning Dove																					
Acorn Woodpecker													3.1	0.3	0.17				0.5	0.1	0.17
Nuttall's Woodpecker	0.7	0.3	0.25	1.7	0.0	0.00	0.3	0.4	0.50	2.1	0.3	0.11	1.7	0.3	0.17	1.0	0.7	0.33	1.2	0.3	0.20
Downy Woodpecker				0.3	0.0	0.00													0.1	0.0	0.00
Northern Flicker													0.4	0.0	0.00				0.1	0.0	0.00
Western Wood-Pewee	0.3	0.0	0.00				0.7	0.0	0.00							0.3	0.0	0.00	0.2	0.0	0.00
"Western" Flycatcher	8.7	0.0	0.00	6.6	0.3	0.04	4.1	0.0	0.00	7.3	0.3	0.08	2.4	0.0	0.00	8.3	0.0	0.00	6.2	0.1	0.01
Black Phoebe	0.0	0.3	1.00	0.0	1.3	1.00							0.0	0.3	1.00	0.0	1.1	1.00	0.0	0.5	1.00
Say's Phoebe																0.0	0.4	1.00	0.0	0.1	1.00
Ash-throated Flycatcher	3.4	0.0	0.00	5.3	0.0	0.00	1.3	0.0	0.00	3.5	1.3	0.19	3.5	0.0	0.00	3.1	0.7	0.19	3.4	0.3	0.12
Cassin's Kingbird				4.3	3.6	0.33													0.7	0.6	0.33
Western Kingbird				0.3	0.7	0.75													0.1	0.1	0.75
Hutton's Vireo	0.3	0.0	0.00	0.7	0.3	0.25	1.4	0.4	0.17	1.4	0.4	0.17							0.6	0.2	0.18
Western Scrub-Jay	1.0	0.3	0.25	1.0	1.0	0.50	0.0	1.0	1.00				0.7	0.0	0.00	3.1	3.1	0.52	1.0	0.9	0.43
N.Rough-winged Swallow	0.3	0.0	0.00	0.3	0.0	0.00	0.0	0.4	1.00										0.1	0.1	0.25
Cliff Swallow				0.3	0.0	0.00	1.1	0.0	0.00										0.2	0.0	0.00
Oak Titmouse										1.7	0.7	0.35	2.4	2.0	0.40	1.0	0.7	0.33	0.9	0.6	0.33
Bushtit	8.0	1.7	0.19	20.0	5.9	0.27	14.9	4.5	0.27	4.6	2.7	0.32	7.3	2.0	0.28	23.2	5.9	0.24	13.1	3.8	0.25
White-breasted Nuthatch													0.4	0.0	0.00				0.1	0.0	0.00
Cactus Wren				0.3	0.0	0.00				1.0	0.3	0.17							0.2	0.1	0.11
Bewick's Wren	5.1	5.7	0.39	2.0	2.7	0.49	2.7	2.1	0.52	7.7	7.0	0.37	3.7	1.3	0.21	3.8	6.2	0.46	4.2	4.2	0.40
House Wren	0.3	0.3	0.50	0.7	0.7	0.33	0.7	0.0	0.00	5.1	3.0	0.20	2.1	1.7	0.24	2.1	4.2	0.60	1.8	1.7	0.33
Blue-gray Gnatcatcher	2.0	1.4	0.19							0.7	1.7	0.42							0.5	0.5	0.23
California Gnatcatcher				0.7	0.0	0.00				0.0	0.3	1.00							0.1	0.1	0.25
Wrentit	15.6	13.8	0.43	22.3	7.3	0.28	42.2	38.5	0.43	26.8	13.7	0.37	18.3	15.1	0.38	26.2	16.4	0.37	25.2	17.4	0.39
Northern Mockingbird				0.3	0.0	0.00	0.0	0.3	1.00	0.0	0.3	1.00				1.4	0.7	0.42	0.3	0.2	0.36
California Thrasher	2.4	2.4	0.42	5.3	8.3	0.47	2.0	1.8	0.33	2.5	1.3	0.47	1.7	1.3	0.47	4.1	3.4	0.41	3.0	3.1	0.43
Phainopepla	0.3	0.0	0.00	0.3	0.0	0.00	0.3	0.3	0.50	0.7	0.0	0.00	0.7	0.0	0.00	1.0	0.0	0.00	0.6	0.1	0.08
Orange-crowned Warbler	6.1	14.9	0.40	5.0	0.0	0.00	8.2	2.4	0.17				1.4	0.0	0.00	0.7	1.4	0.67	3.6	3.1	0.30
Yellow Warbler	3.0	0.0	0.00	2.3	0.0	0.00	1.7	0.0	0.00	1.0	0.0	0.00				1.1	0.0	0.00	1.5	0.0	0.00

Table 8. (cont.) Mean numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated all three years 2000-2002 on the Nature Reserve of Orange County averaged over the three years, 2000-2002. Data for each species are included only from stations that lie within the breeding range of the species.

	L.Sycamore Can.			U. Laurel Can.			U. Wood Can.			Weir Canyon			Irvine Park			U. Weir Can.			All stations pooled		
Species	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.	Ad.	Yg.	Prop.[1] Yg.
Common Yellowthroat	3.7	1.3	0.33	14.0	16.0	0.40	8.1	2.8	0.24	0.0	0.3	1.00	0.3	0.3	0.50	2.5	2.1	0.18	4.8	3.9	0.35
Yellow-breasted Chat				1.7	0.0	0.00													0.3	0.0	0.00
Spotted Towhee	13.8	1.7	0.10	18.2	6.9	0.20	14.2	7.9	0.31	9.5	5.7	0.42	8.9	5.0	0.29	11.0	8.6	0.48	12.6	6.0	0.28
California Towhee	5.7	1.7	0.18	17.3	9.3	0.29	2.4	1.0	0.24	17.3	7.0	0.32	11.6	5.0	0.23	7.5	10.7	0.48	10.2	5.8	0.31
Rufous-crowned Sparrow	2.4	5.4	0.56	0.0	0.7	1.00	0.0	0.4	1.00	1.0	2.0	0.70	4.5	9.4	0.49	2.1	1.4	0.42	1.7	3.2	0.51
Black-chinned Sparrow										0.0	0.3	1.00				0.7	0.3	0.25	0.1	0.1	0.33
Lark Sparrow				0.3	0.0	0.00				0.0	0.3	1.00							0.1	0.1	0.50
Grasshopper Sparrow				0.3	0.0	0.00													0.1	0.0	0.00
Song Sparrow	1.0	0.7	0.33	8.3	7.0	0.37	4.7	5.2	0.42				0.0	0.3	1.00	2.8	2.4	0.36	2.8	2.6	0.39
Black-headed Grosbeak	0.7	0.0	0.00	1.3	0.0	0.00	0.7	0.0	0.00				1.0	0.7	0.63	2.4	1.0	0.22	1.0	0.3	0.17
Blue Grosbeak				3.0	0.3	0.17	0.0	0.4	1.00	0.0	0.3	1.00	0.7	0.0	0.00	0.3	0.0	0.00	0.7	0.2	0.25
Lazuli Bunting				1.6	2.0	0.55	0.7	0.0	0.00	0.7	1.0	0.67	2.0	0.7	0.13	1.7	0.0	0.00	1.1	0.6	0.23
Hooded Oriole							0.0	0.4	1.00							0.7	0.0	0.00	0.1	0.1	0.33
Bullock's Oriole	0.3	0.0	0.00	4.0	0.7	0.10				0.3	0.0	0.00							0.8	0.1	0.09
House Finch	3.0	1.0	0.24	1.0	0.7	0.33	4.1	4.1	0.60	0.7	1.3	0.75	1.0	1.7	0.63	13.0	13.7	0.51	3.8	3.7	0.49
Lesser Goldfinch	2.7	1.0	0.15	8.9	2.0	0.16	3.4	0.0	0.00	4.7	1.0	0.21	3.0	0.0	0.00	13.7	5.0	0.17	6.1	1.5	0.13
Lawrence's Goldfinch				4.6	0.0	0.00													0.8	0.0	0.00
ALL SPECIES POOLED	91.1	54.0	0.29	164.7	77.7	0.28	120.0	74.2	0.35	100.3	52.7	0.33	82.6	47.6	0.31	138.8	90.2	0.37	116.4	66.0	0.32
NUMBER OF SPECIES	25	17		35	21		22	19		21	24		24	17		27	22		44	37	
TOTAL NUMBER OF SPECIES		26			37			28			27			26			29			46	

[1] Years for which the proportion of young was undefined (no aged birds were captured in the year) are not included in the mean proportion of young.

Table 9. Estimates of adult survival and recapture probabilities and proportion of residents using for a time-constant model for eight species breeding at four MAPS stations (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park) on the Nature Reserve of Orange County obtained from four years (1999-2002) of mark-recapture data.

Species	Num. sta[1]	Num. ind.[2]	Num. caps.[3]	Num. ret.[4]	$QAIC_C$[5]	Survival probability[6]	Surv. C.V.[7]	Recapture probability[8]	Proportion of residents[9]
Bushtit	4	177	224	17	33.4	0.396 (0.135)	34.1	0.304 (0.159)	0.758 (0.402)
Bewick's Wren	4	72	114	15	29.4	0.378 (0.110)	29.2	0.762 (0.198)	0.532 (0.241)
Wrentit	4	288	490	64	47.7	0.578 (0.070)	12.0	0.594 (0.088)	0.468 (0.100)
California Thrasher	4	47	61	4	21.3	0.447 (0.276)	61.8	0.311 (0.299)	0.474 (0.439)
Spotted Towhee	4	201	258	28	21.0	0.351 (0.104)	29.7	0.356 (0.147)	1.000 (0.447)
California Towhee	4	207	274	29	28.7	0.490 (0.107)	21.8	0.426 (0.128)	0.460 (0.154)
Rufous-crowned Sparrow	4	41	58	3	19.4	0.890 (0.585)	65.7	0.057 (0.084)	0.786 (0.904)
Song Sparrow	1	40	72	7	25.7	0.695 (0.239)	34.4	0.321 (0.199)	0.220 (0.170)

[1] Number of stations where the species was a regular or usual breeder at which adults of the species were captured.
[2] Number of adult individuals captured at stations where the species was a regular or usual breeder (i.e., number of capture histories).
[3] Total number of captures of adult birds of the species at stations where the species was a regular or usual breeder.
[4] Total number of returns. A return is the first recapture in a given year of a bird originally banded at the same station in a previous year.
[5] Akaike Information Criterion ($QAIC_C$) given as -2(log-likelihood) + 2(number of estimable parameters) with corrections for small sample size and overdispersion of data.
[6] Survival probability presented as the maximum likelihood estimate (standard error of the estimate).
[7] The coefficient of variation for survival probability.
[8] Recapture probability presented as the maximum likelihood estimate (standard error of the estimate).
[9] The proportion of residents among newly captured adults presented as the maximum likelihood estimate (standard error of the estimate).

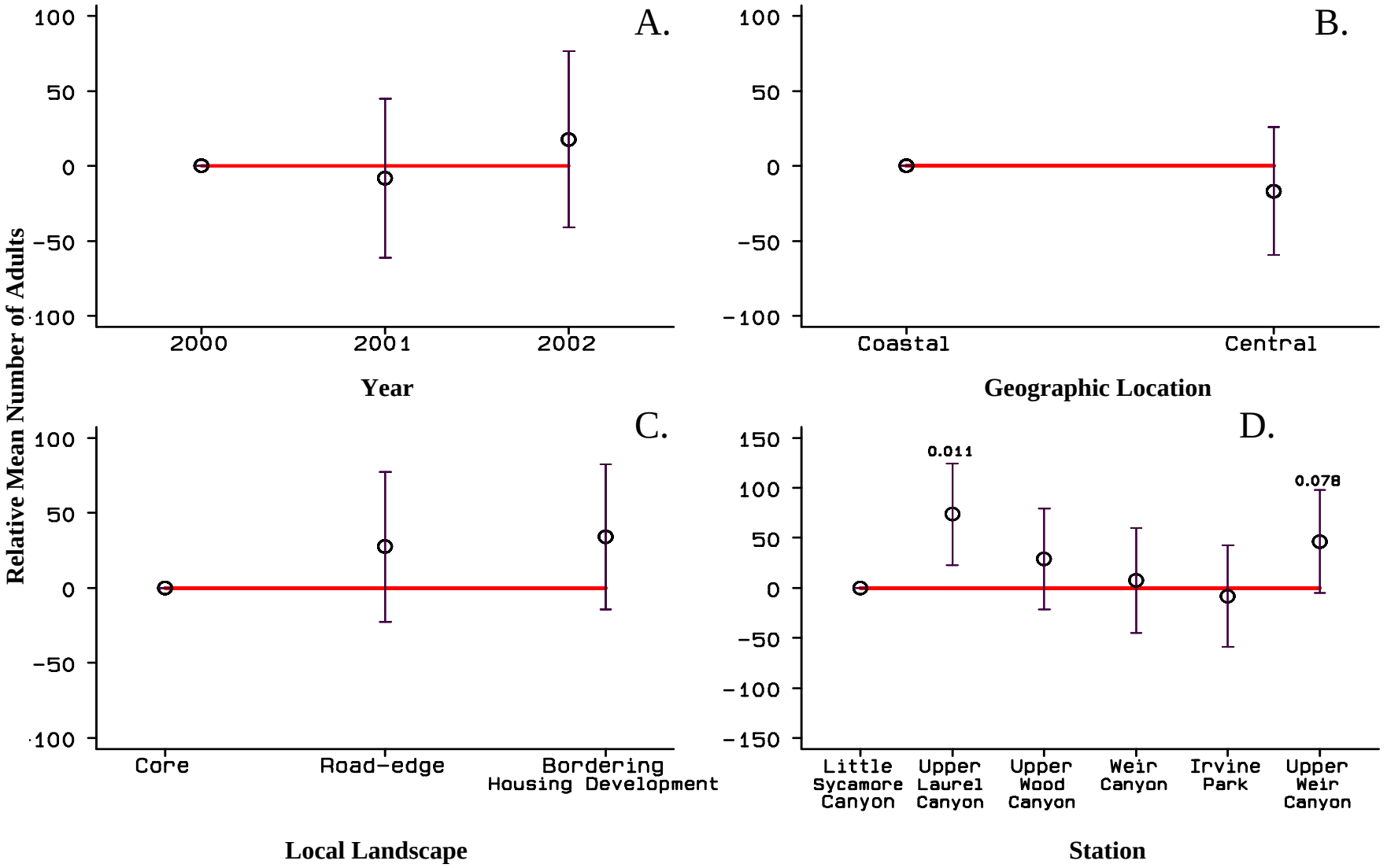


Figure 1. Relative mean **numbers of adults** (with 95% confidence intervals) for **all species pooled** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

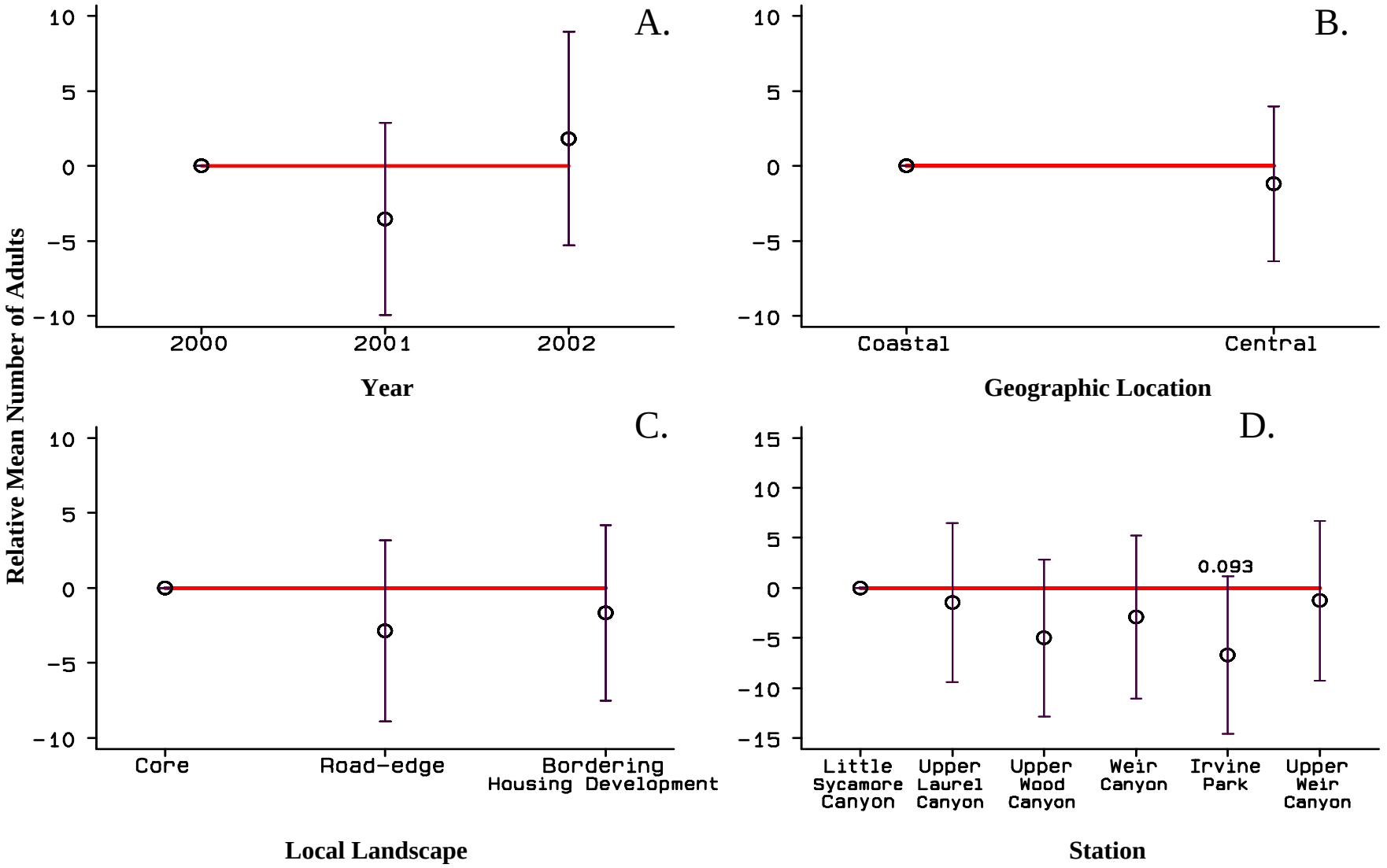


Figure 2. Relative mean **numbers of adults** (with 95% confidence intervals) for **Western Flycatcher** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

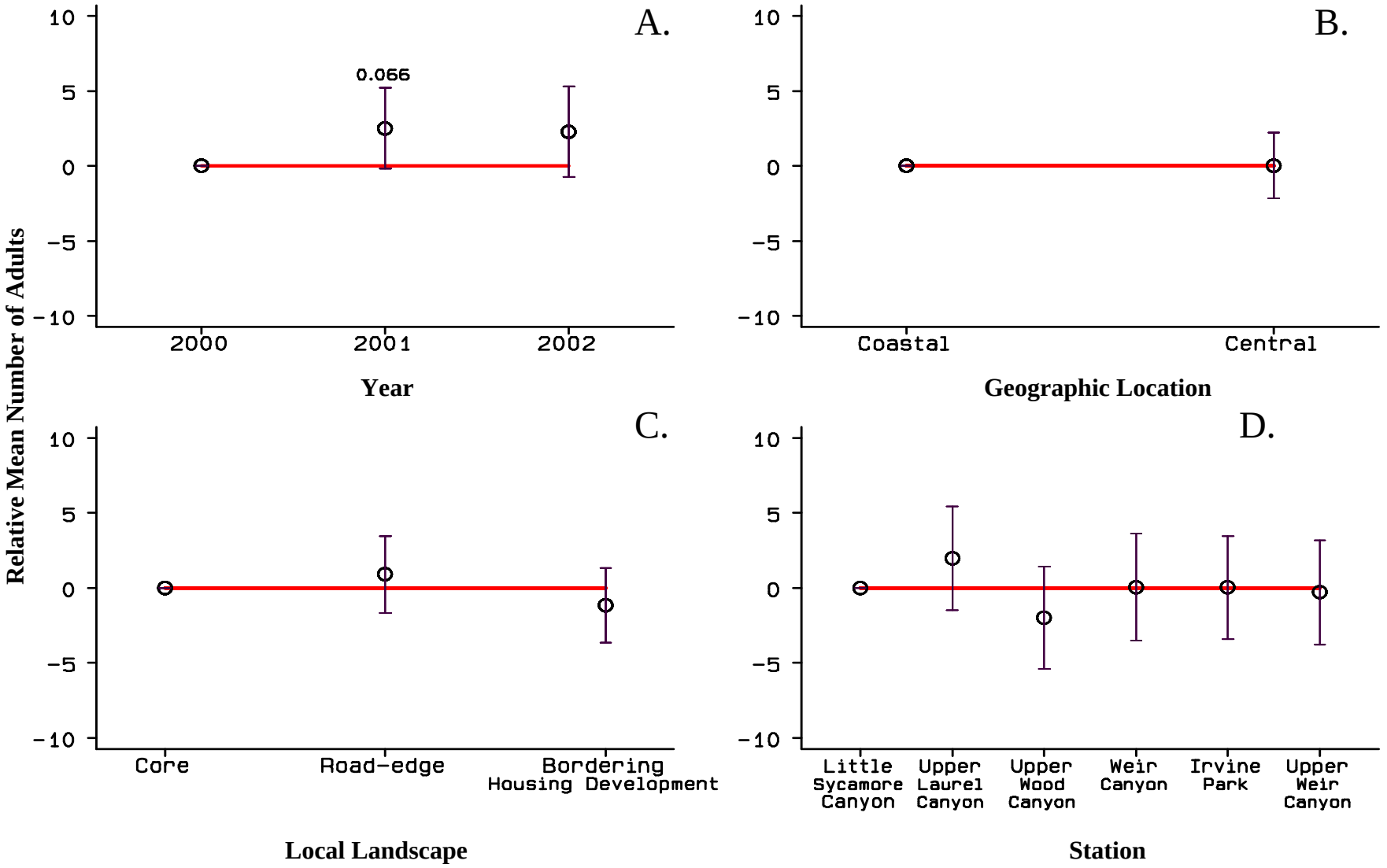


Figure 3. Relative mean **numbers of adults** (with 95% confidence intervals) for **Ash-throated Flycatcher** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

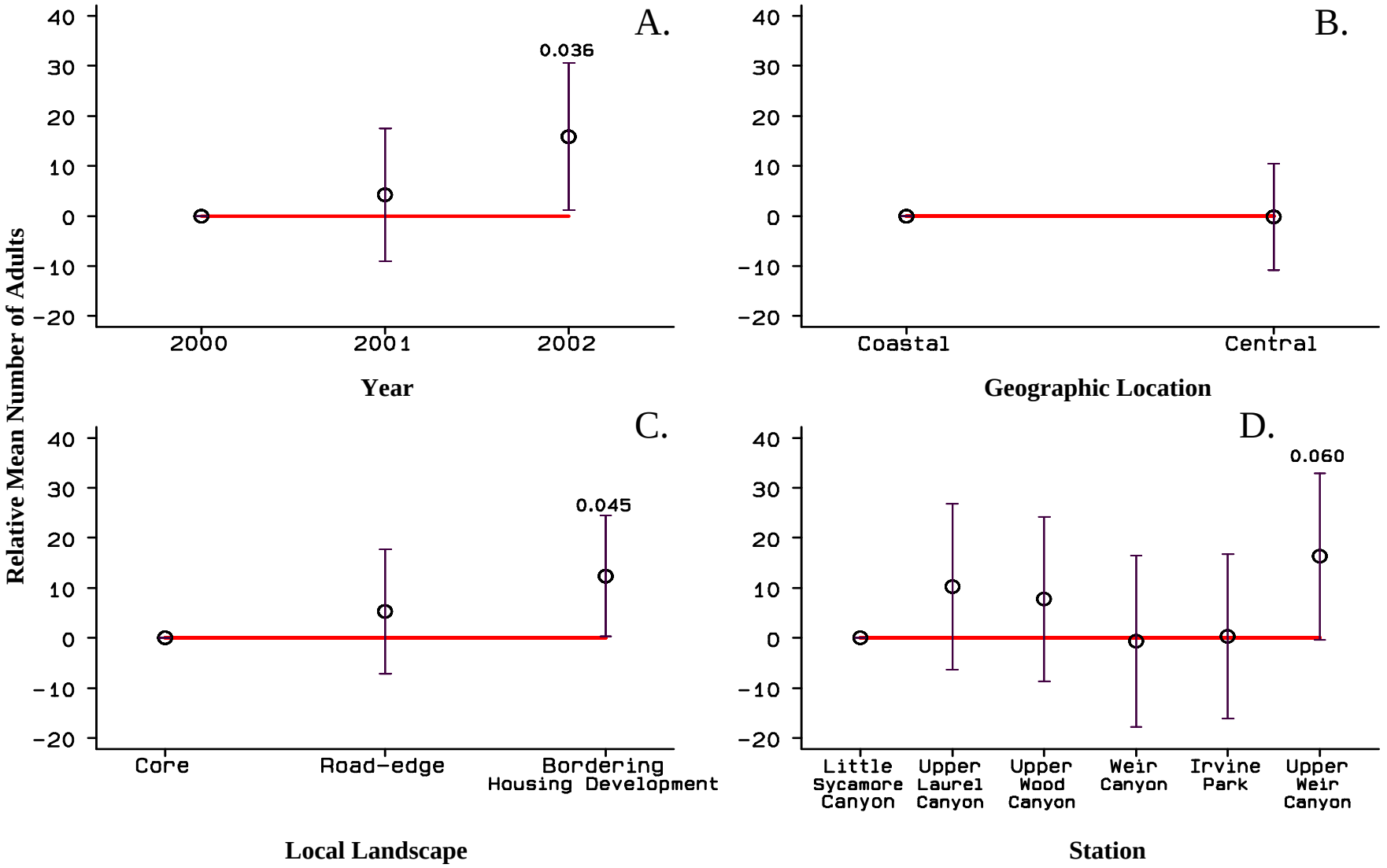


Figure 4. Relative mea **numbers of adults** (with 95% confidence intervals) for **Bushtit** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

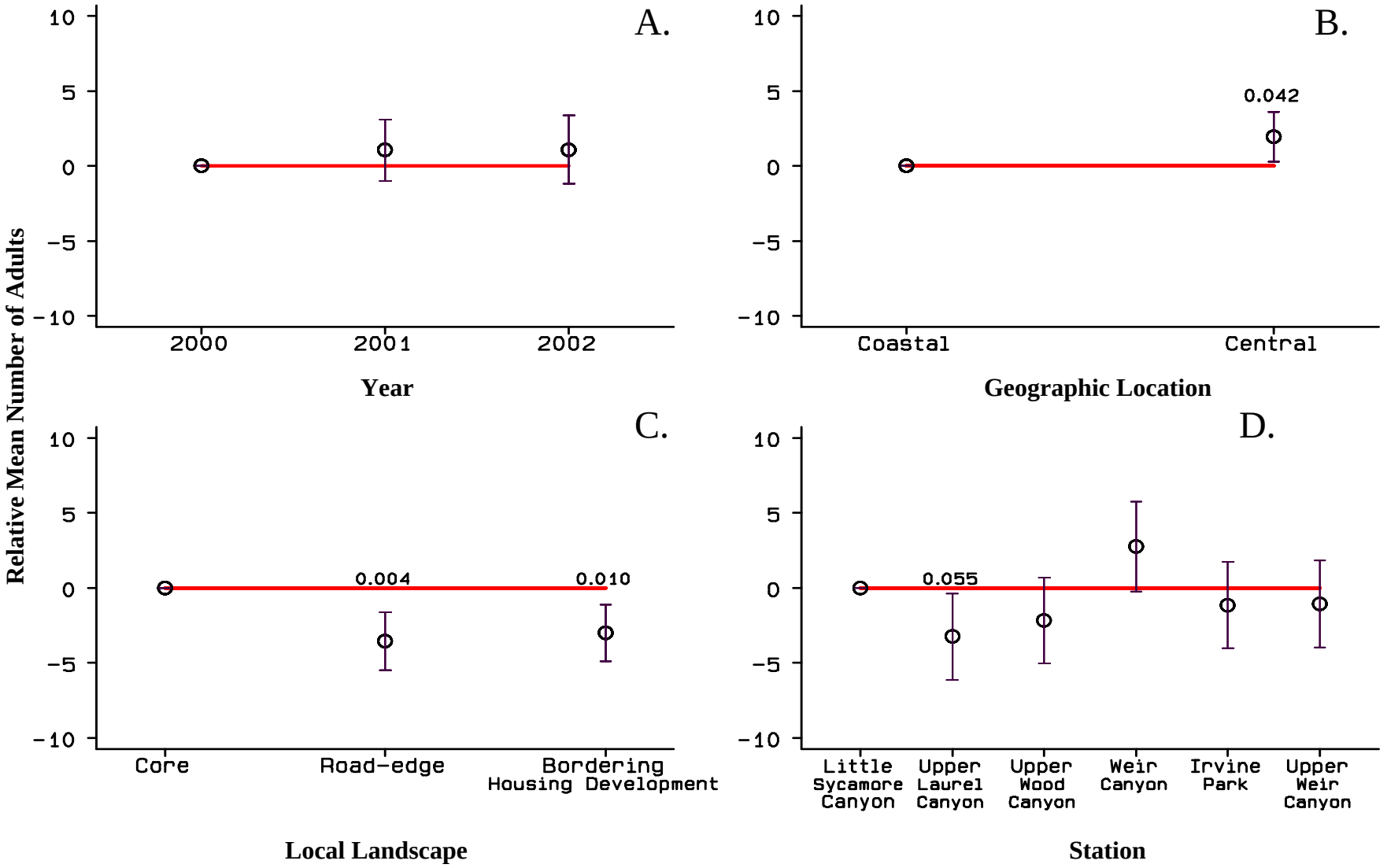


Figure 5. Relative mean **numbers of adults** (with 95% confidence intervals) for **Bewick's Wren** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

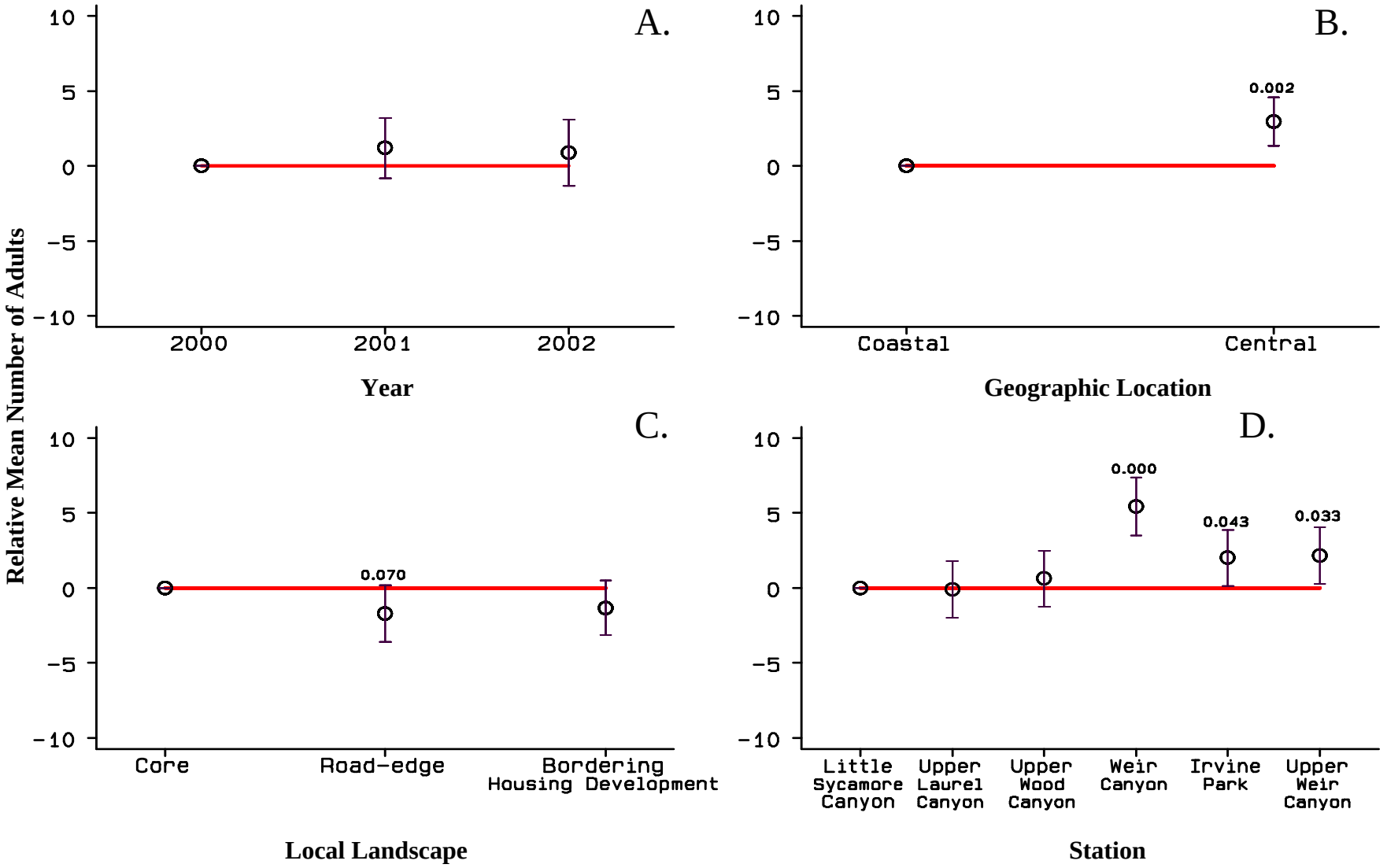


Figure 6. Relative mean **numbers of adults** (with 95% confidence intervals) for **House Wren** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

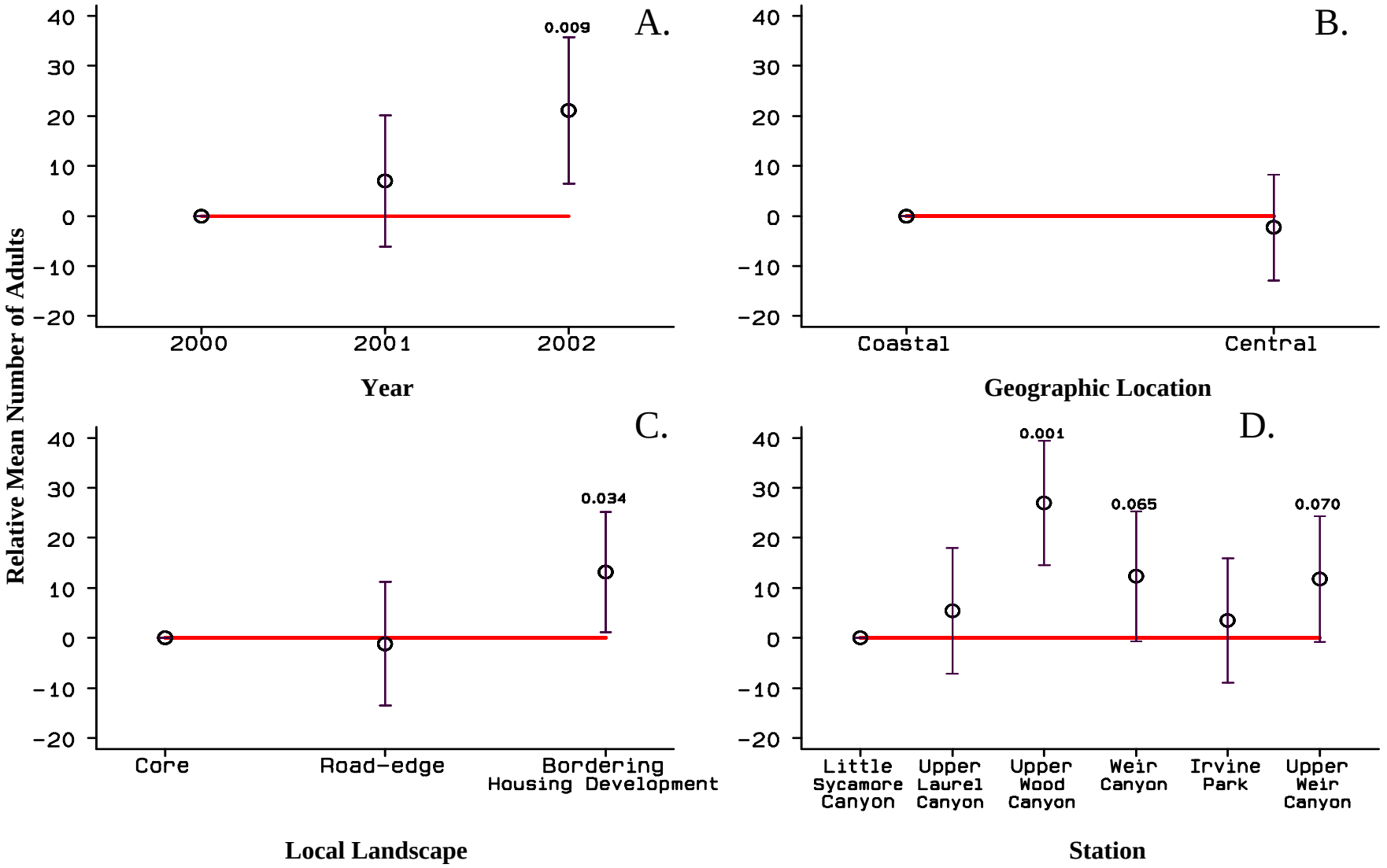


Figure 7. Relative mean **numbers of adults** (with 95% confidence intervals) for **Wrentit** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

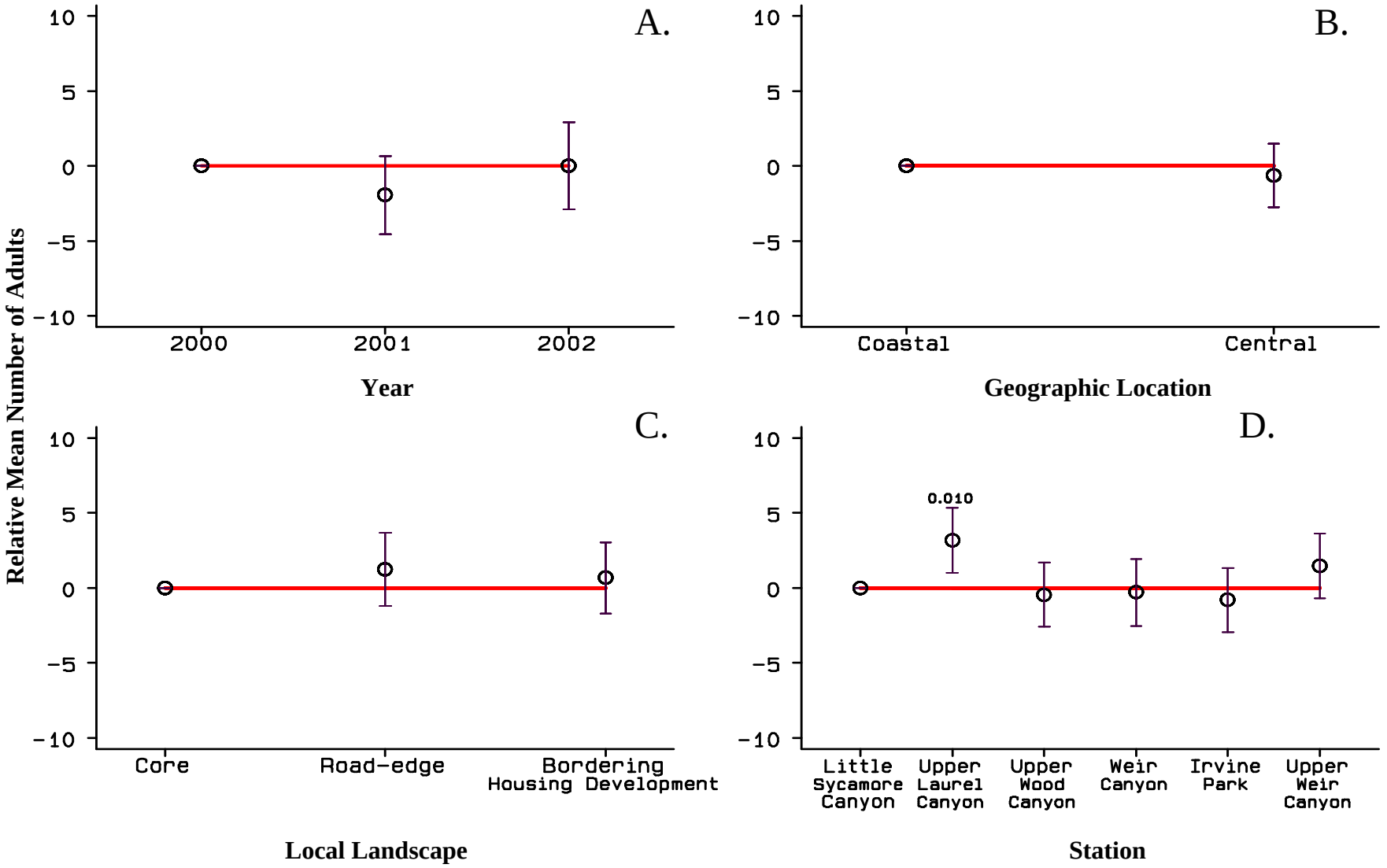


Figure 8. Relative mean **numbers of adults** (with 95% confidence intervals) for **California Thrasher** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

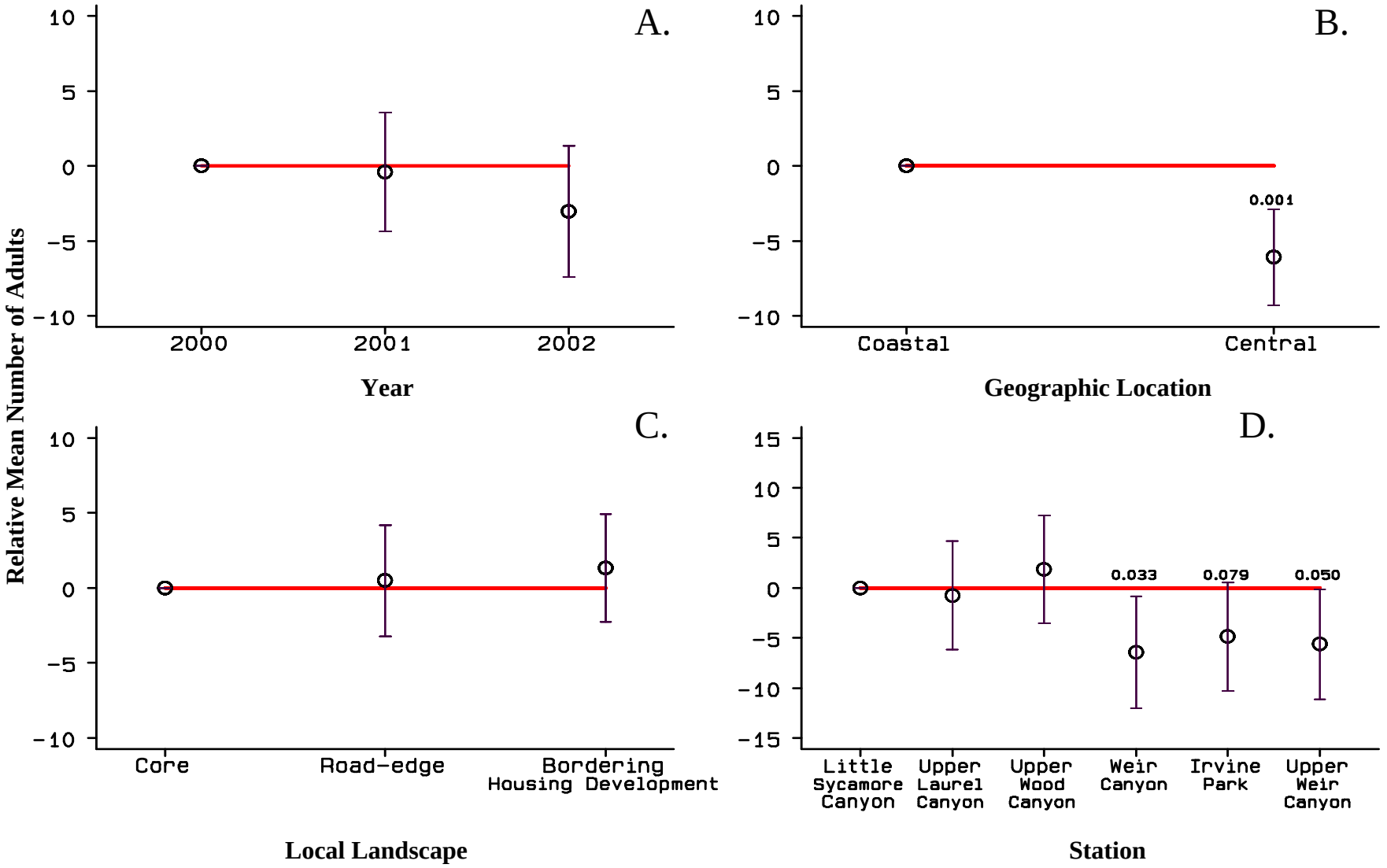


Figure 9. Relative mean **numbers of adults** (with 95% confidence intervals) for **Orange-crowned Warbler** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

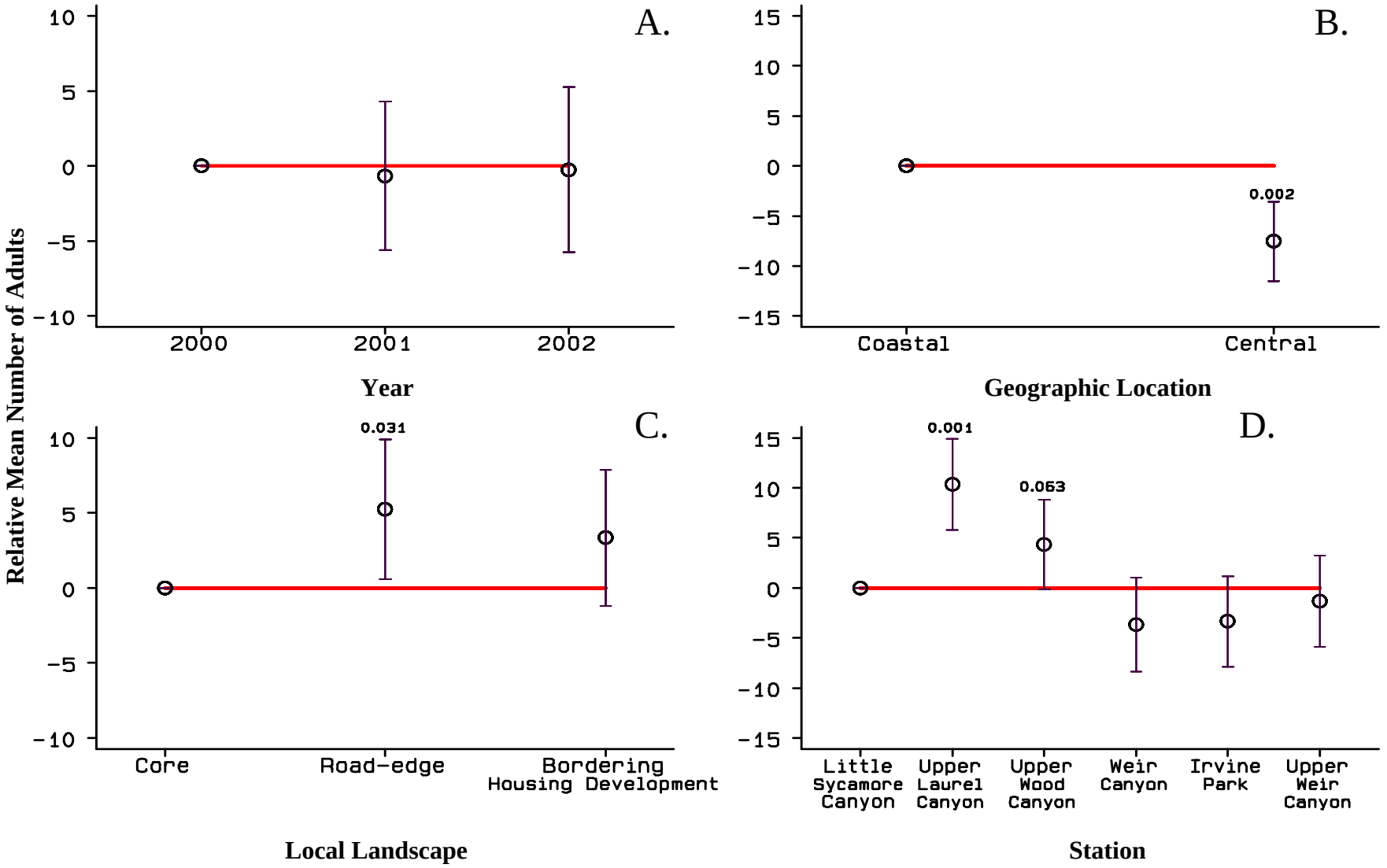


Figure 10. Relative mean **numbers of adults** (with 95% confidence intervals) for **Common Yellowthroat** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

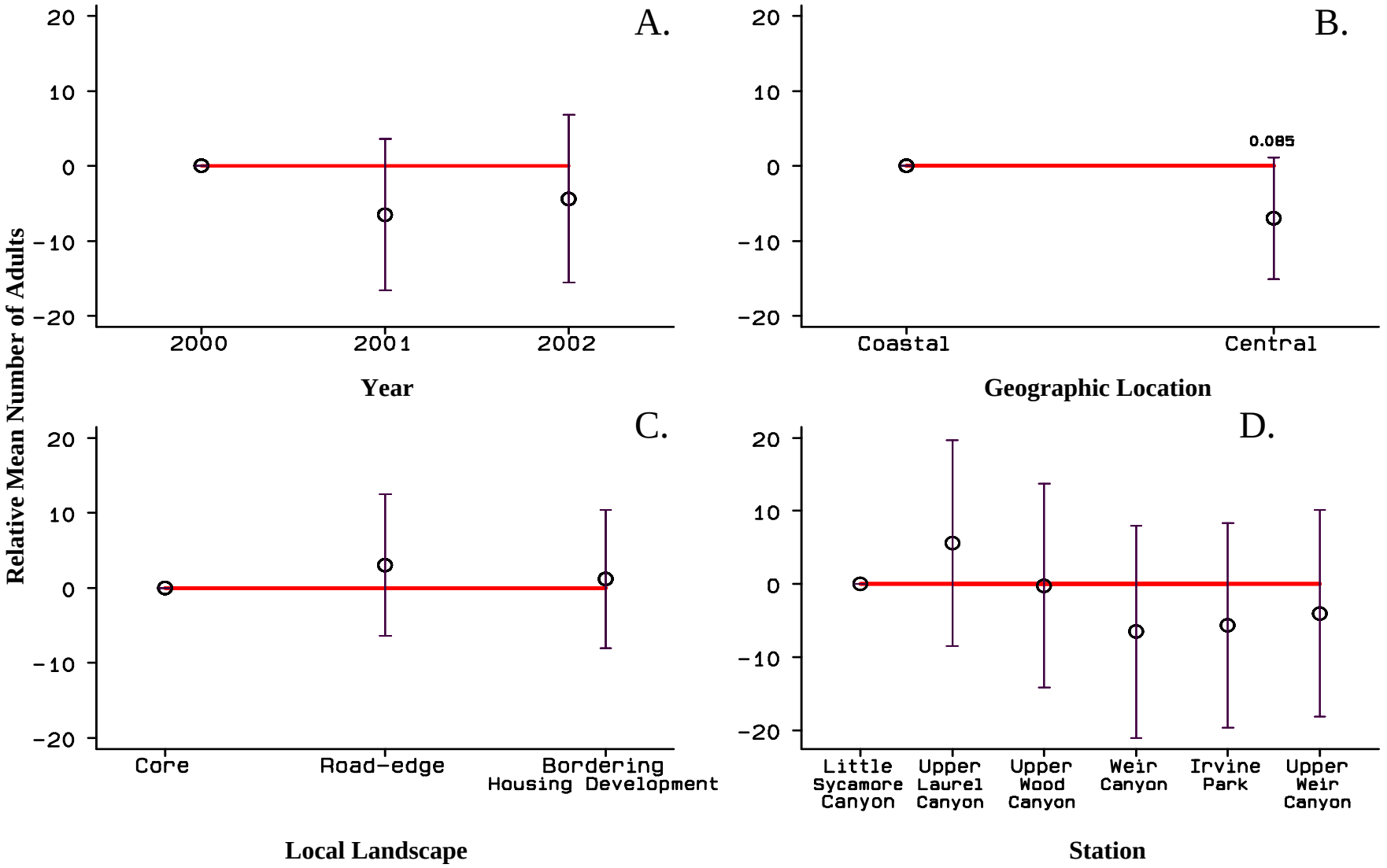


Figure 11. Relative mean **numbers of adults** (with 95% confidence intervals) for **Spotted Towhee** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

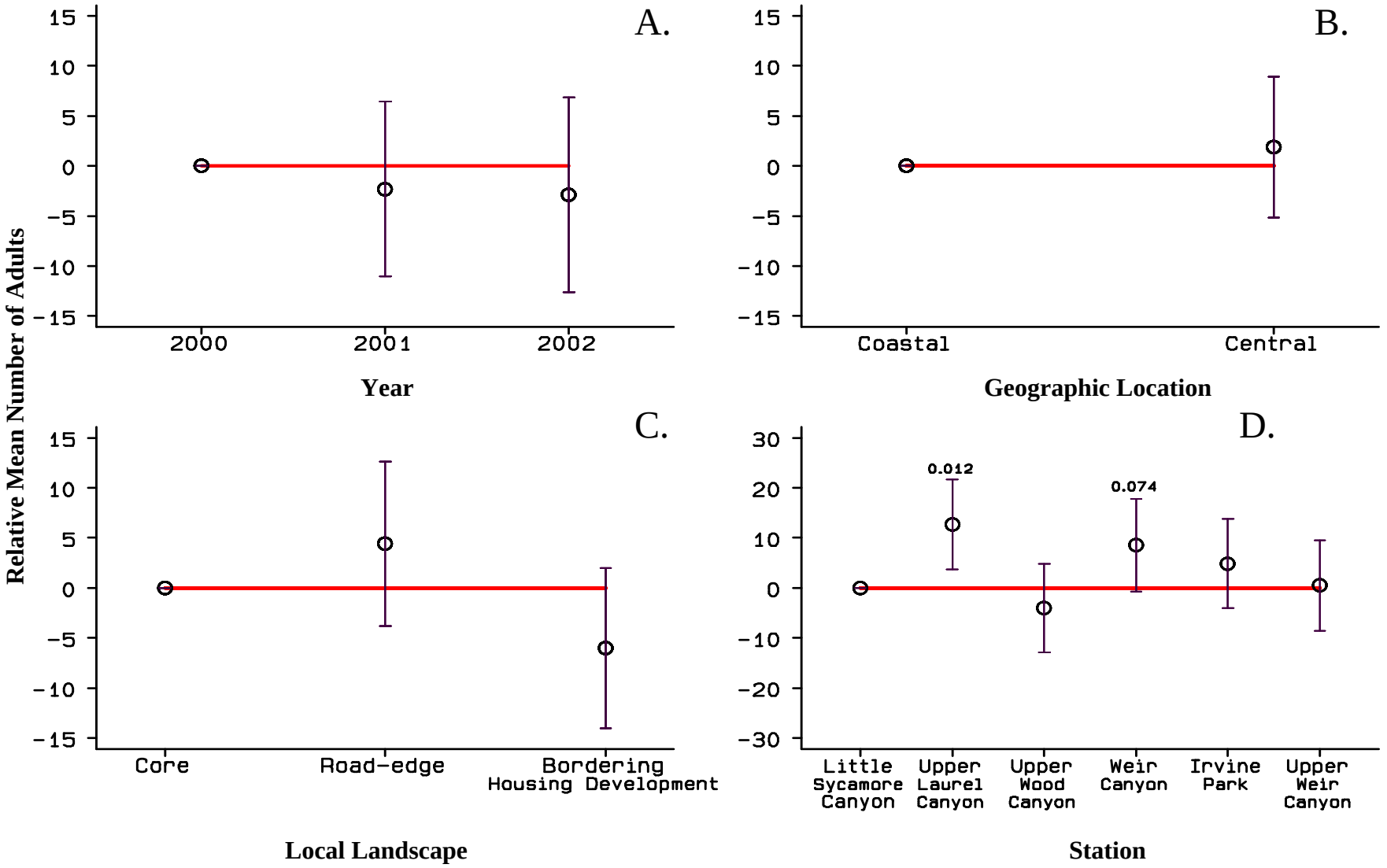


Figure 12. Relative mean **numbers of adults** (with 95% confidence intervals) for **California Towhee** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

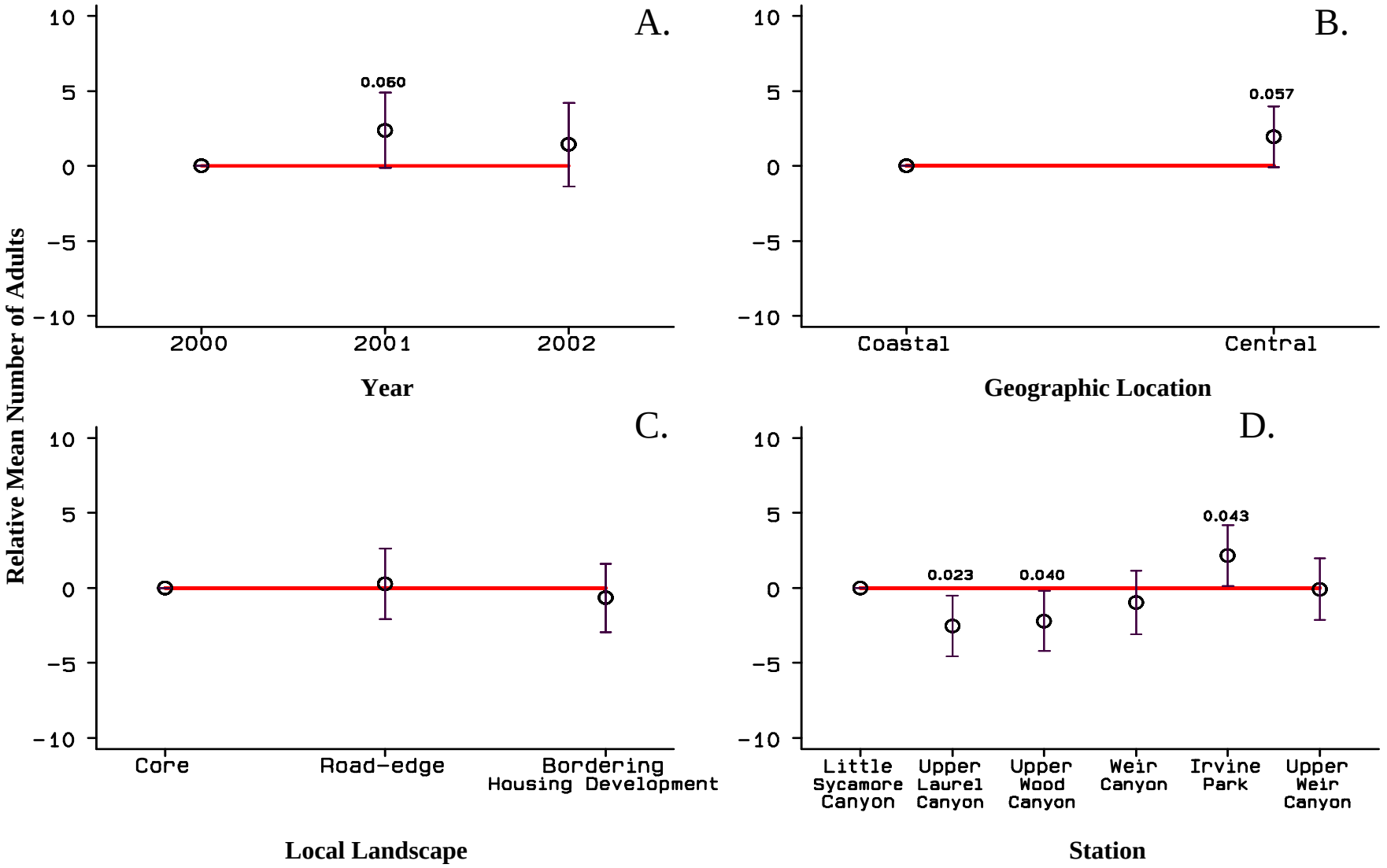


Figure 13. Relative mean **numbers of adults** (with 95% confidence intervals) for **Rufous-crowned Sparrow** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

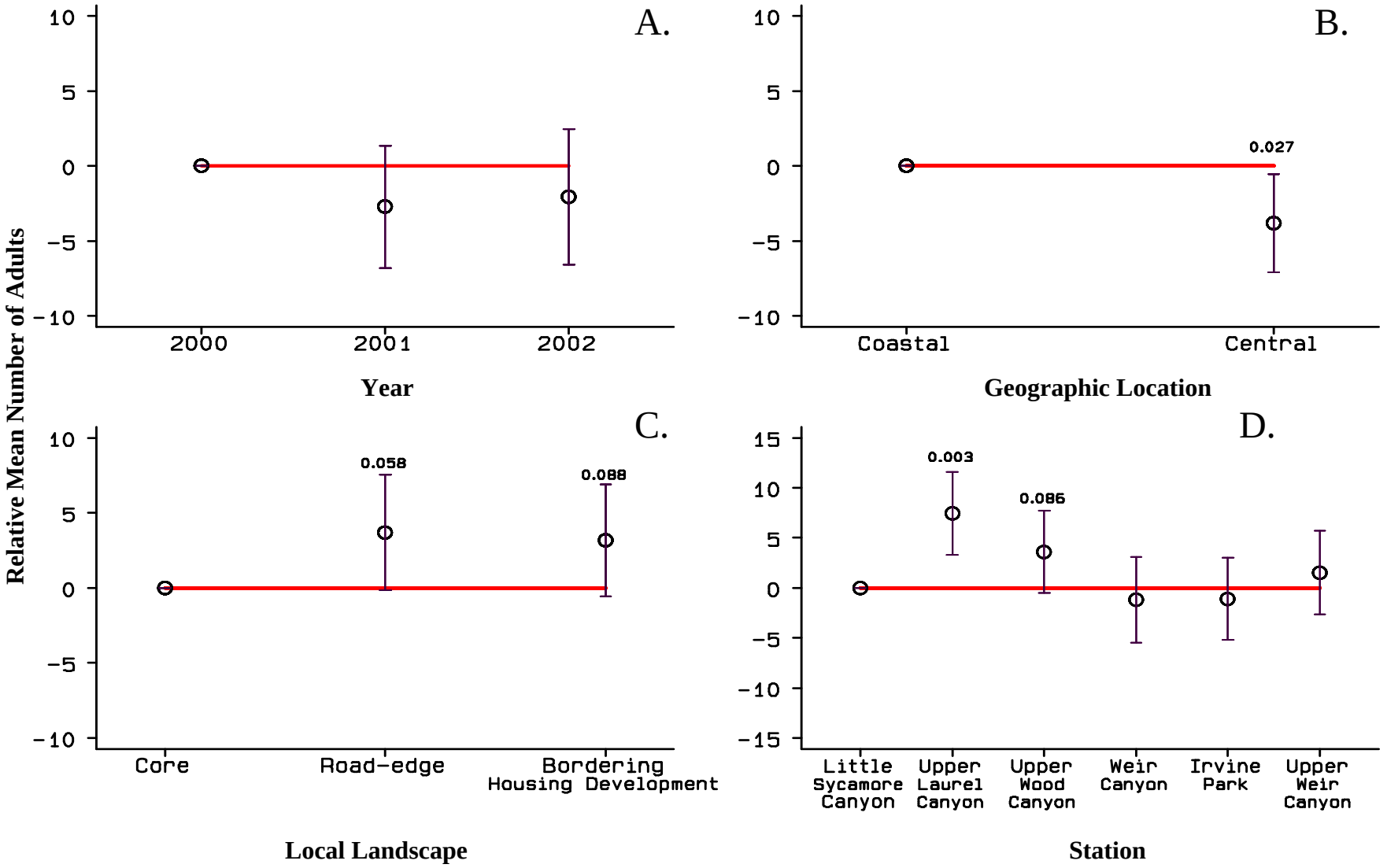


Figure 14. Relative mean **numbers of adults** (with 95% confidence intervals) for **Song Sparrow** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

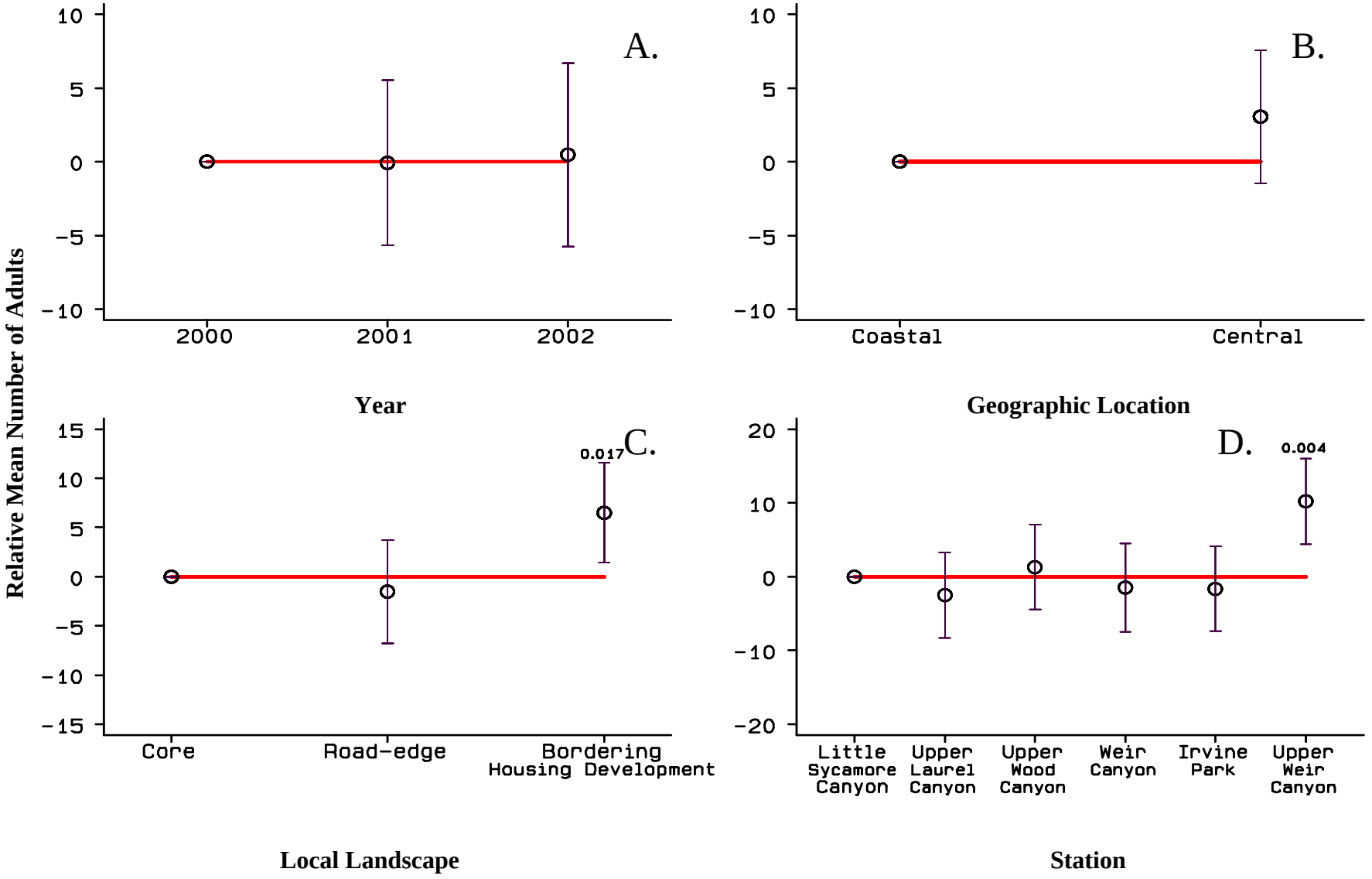


Figure 15. Relative mean **numbers of adults** (with 95% confidence intervals) for **House Finch** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

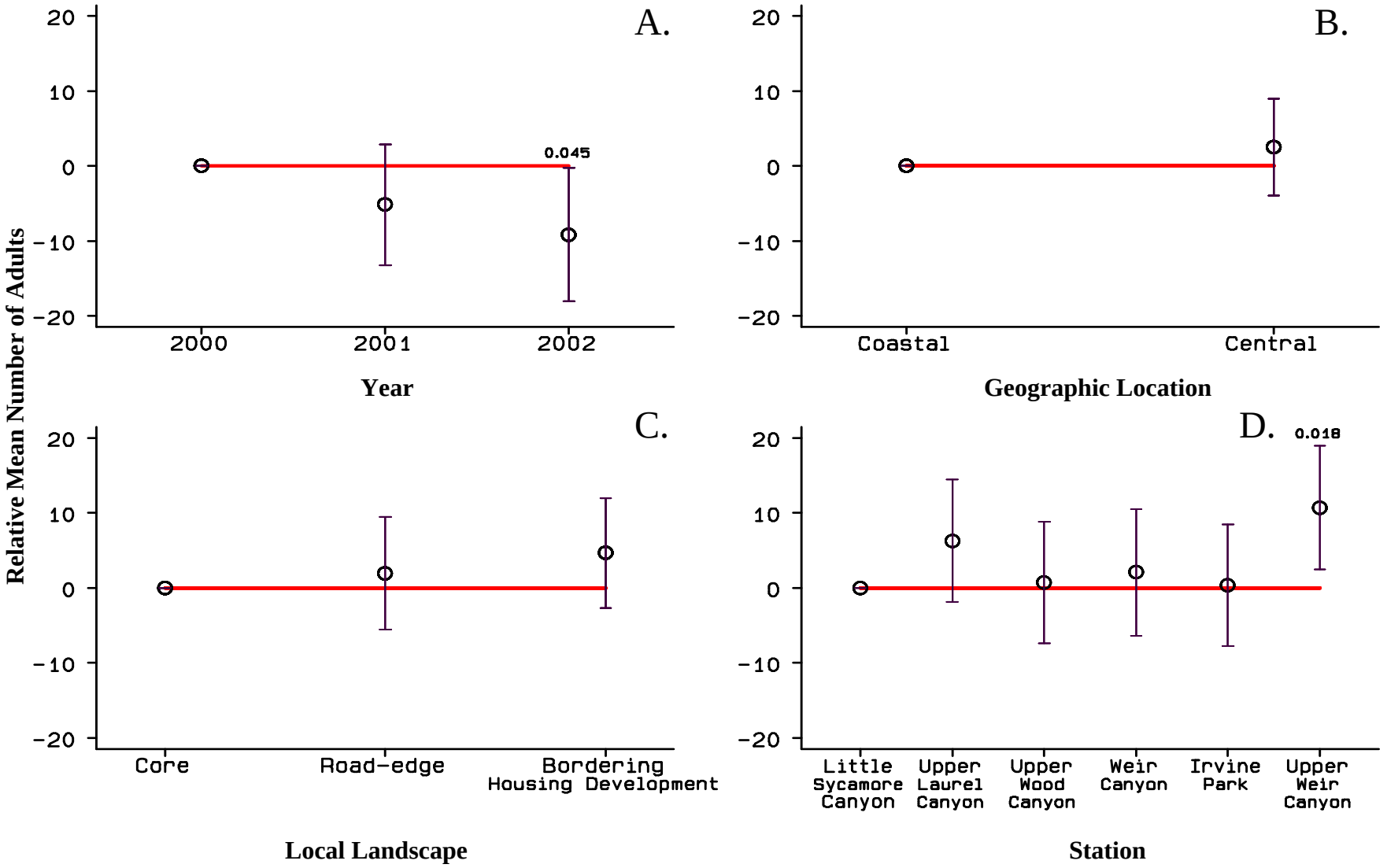


Figure 16. Relative mean **numbers of adults** (with 95% confidence intervals) for **Lesser Goldfinch** captured at six stations on the Nature Reserve of Orange County as a function of the variables: A - year, B - geographic location, C - local landscape, and D - station. Relative mean numbers were estimated using a multivariate ANOVA, thus controlling for the other variables while calculating the effect of the target variable. The ANOVA for figures A-C includes the factors year, geographic location, and local landscape. The ANOVA for figure D only includes the factors year and station. For each variable, the estimated relative mean numbers are compared to a reference value (lacking a 95% confidence interval) set at zero, and these zero values are plotted as reference lines for ease of comparison.

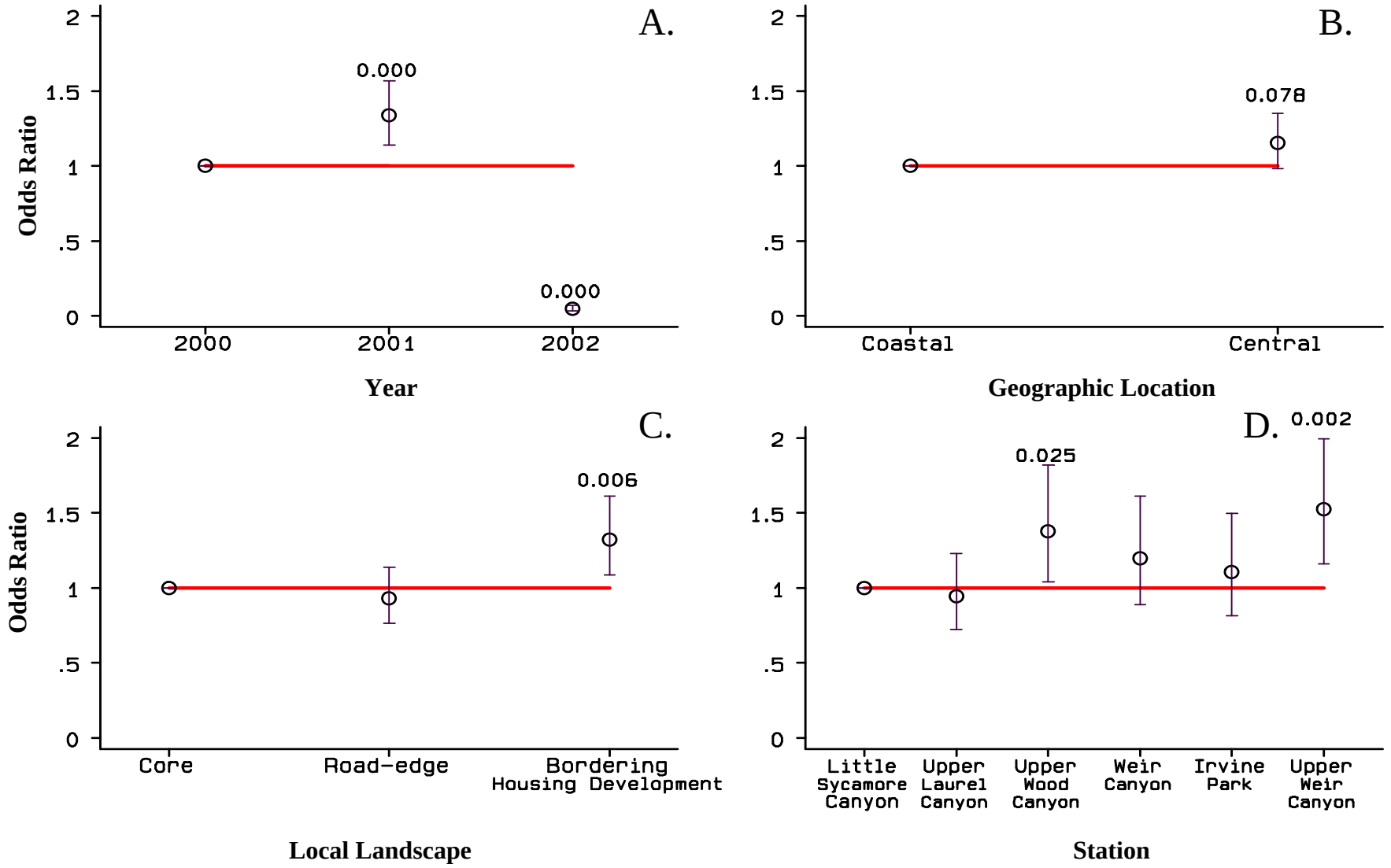


Figure 17. The odds ratios for **productivity indices** (with 95% confidence intervals) for **all species pooled** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

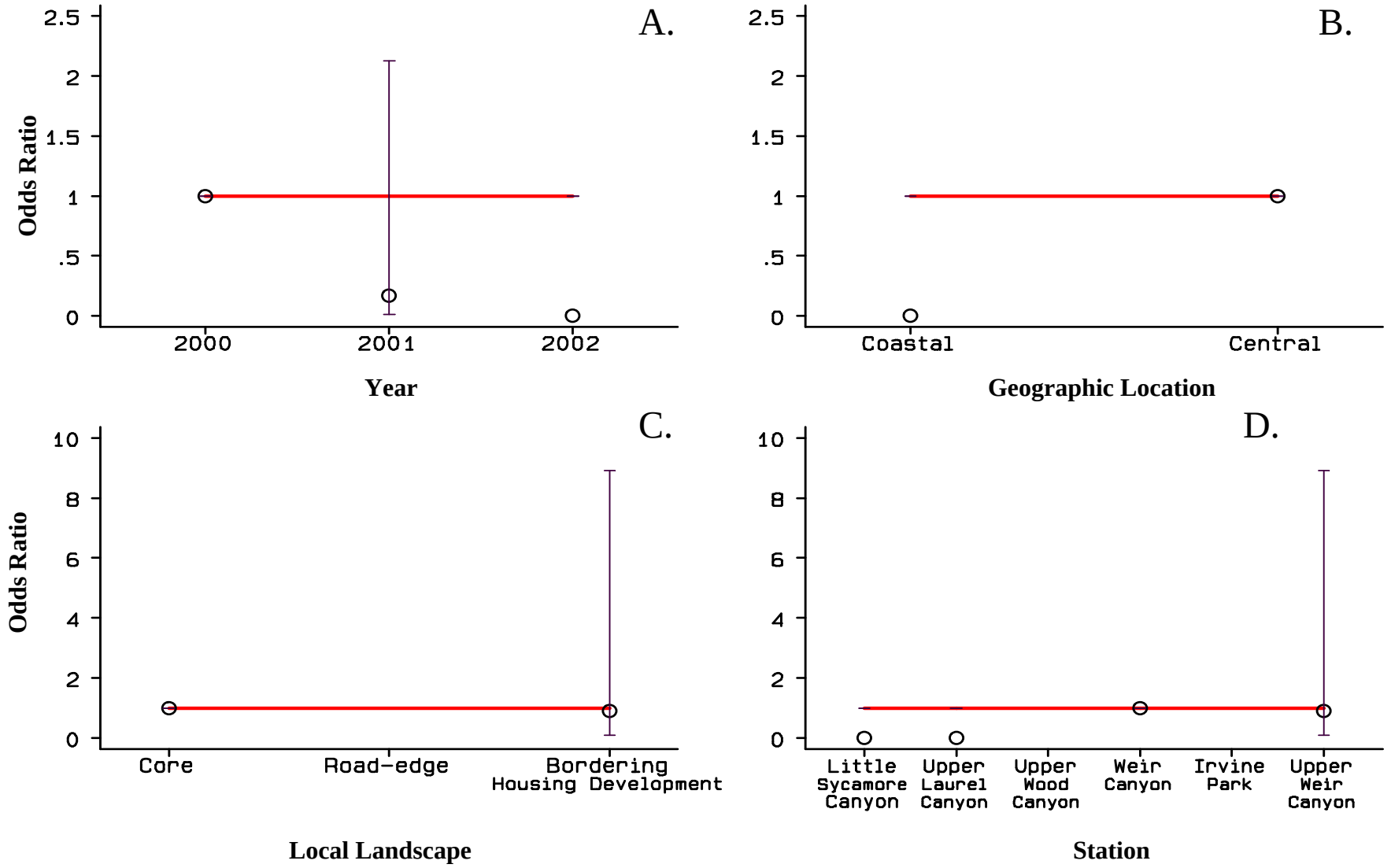


Figure 18. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Ash-throated Flycatcher** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

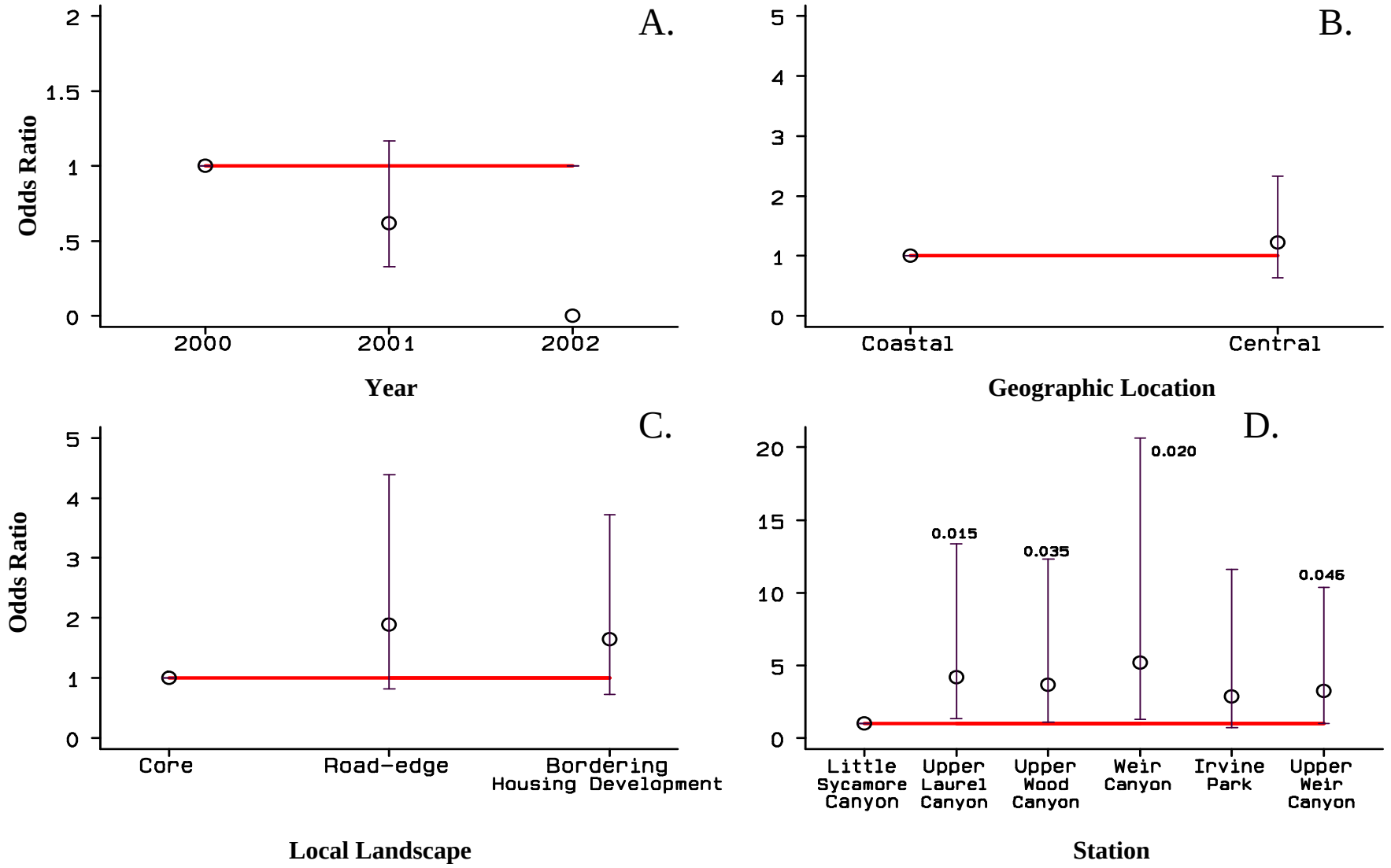


Figure 19. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Bushtit** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

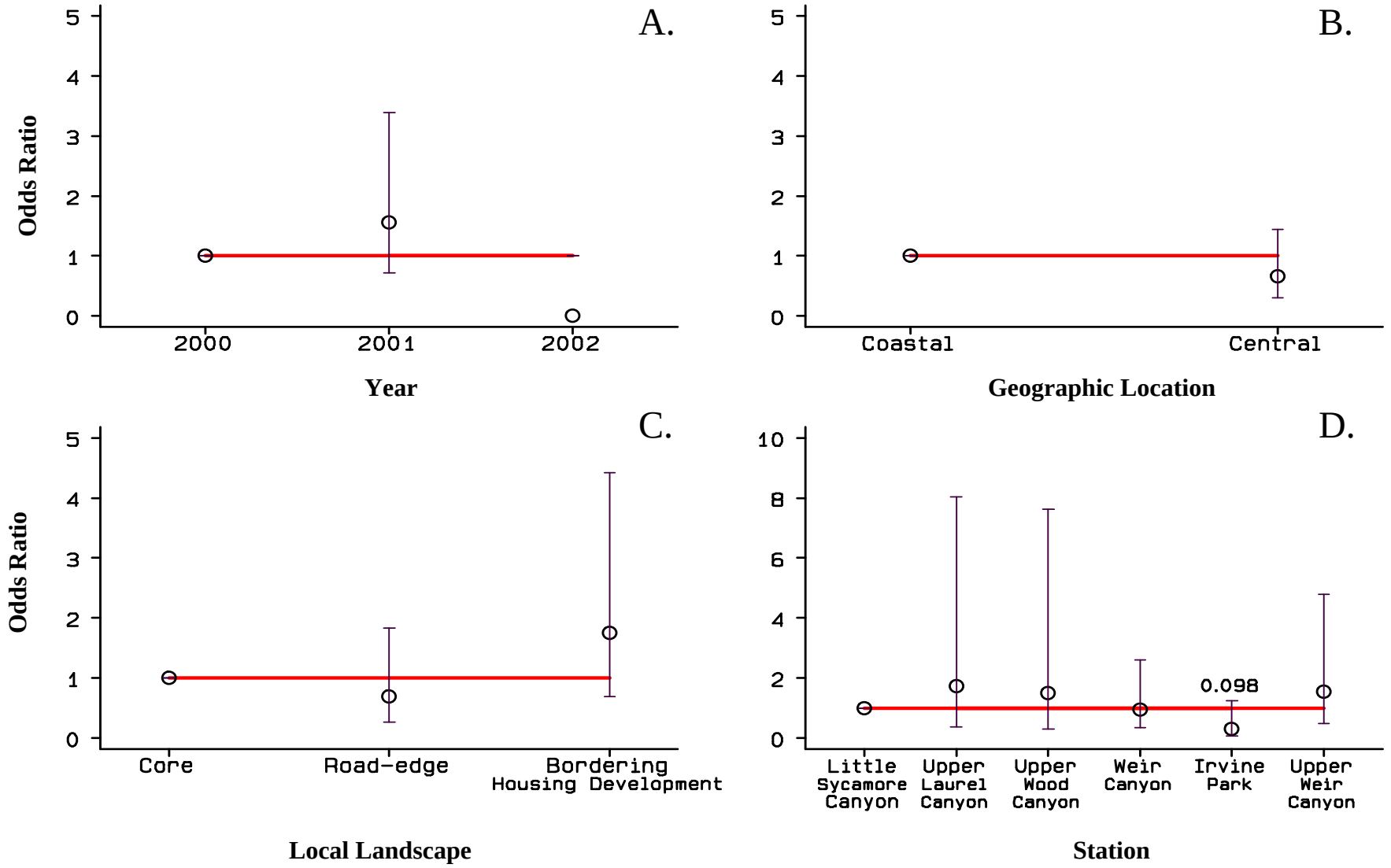


Figure 20. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Bewick's Wren** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

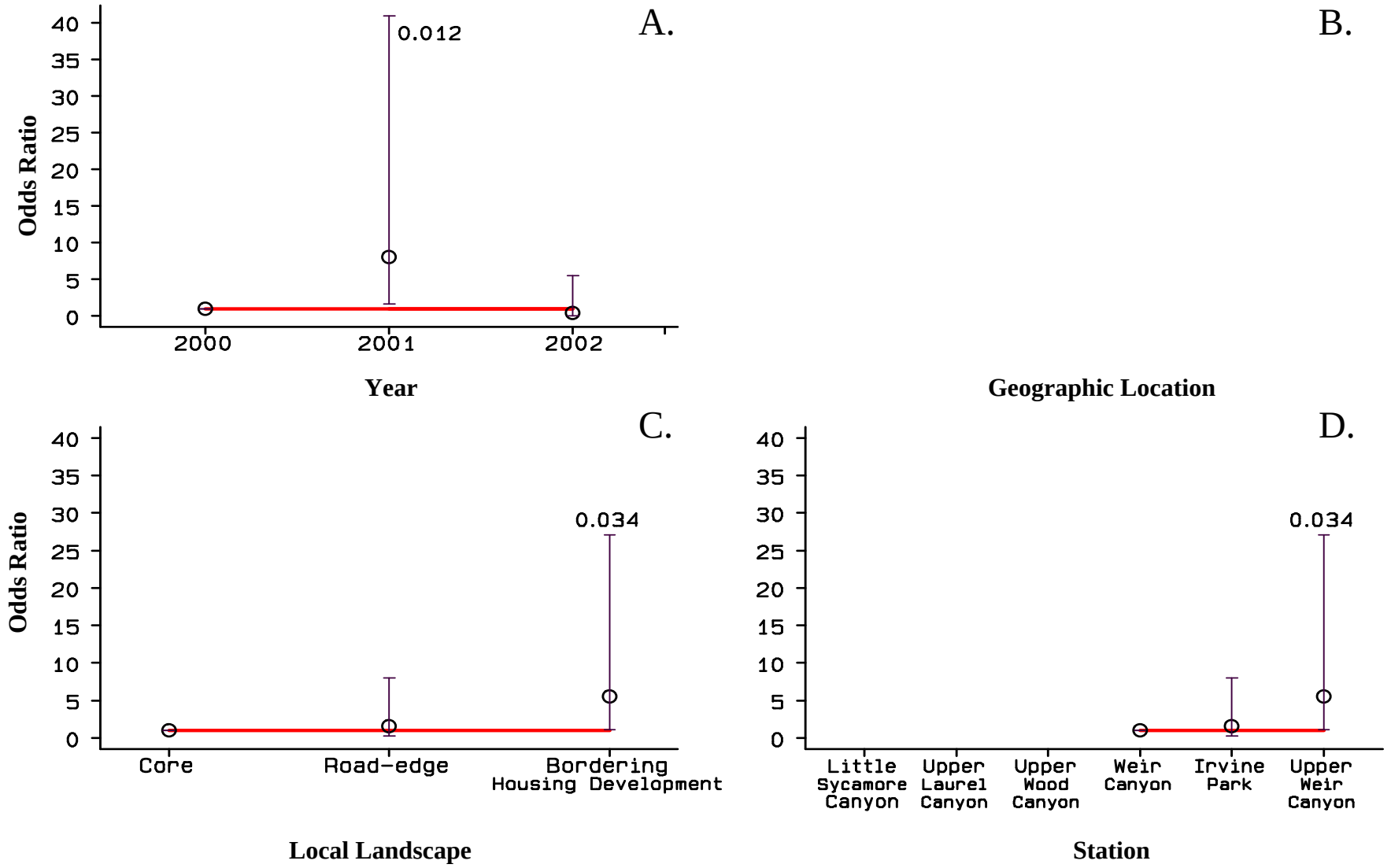


Figure 21. The odds ratios for **productivity indices** (with 95% confidence intervals) for **House Wren** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

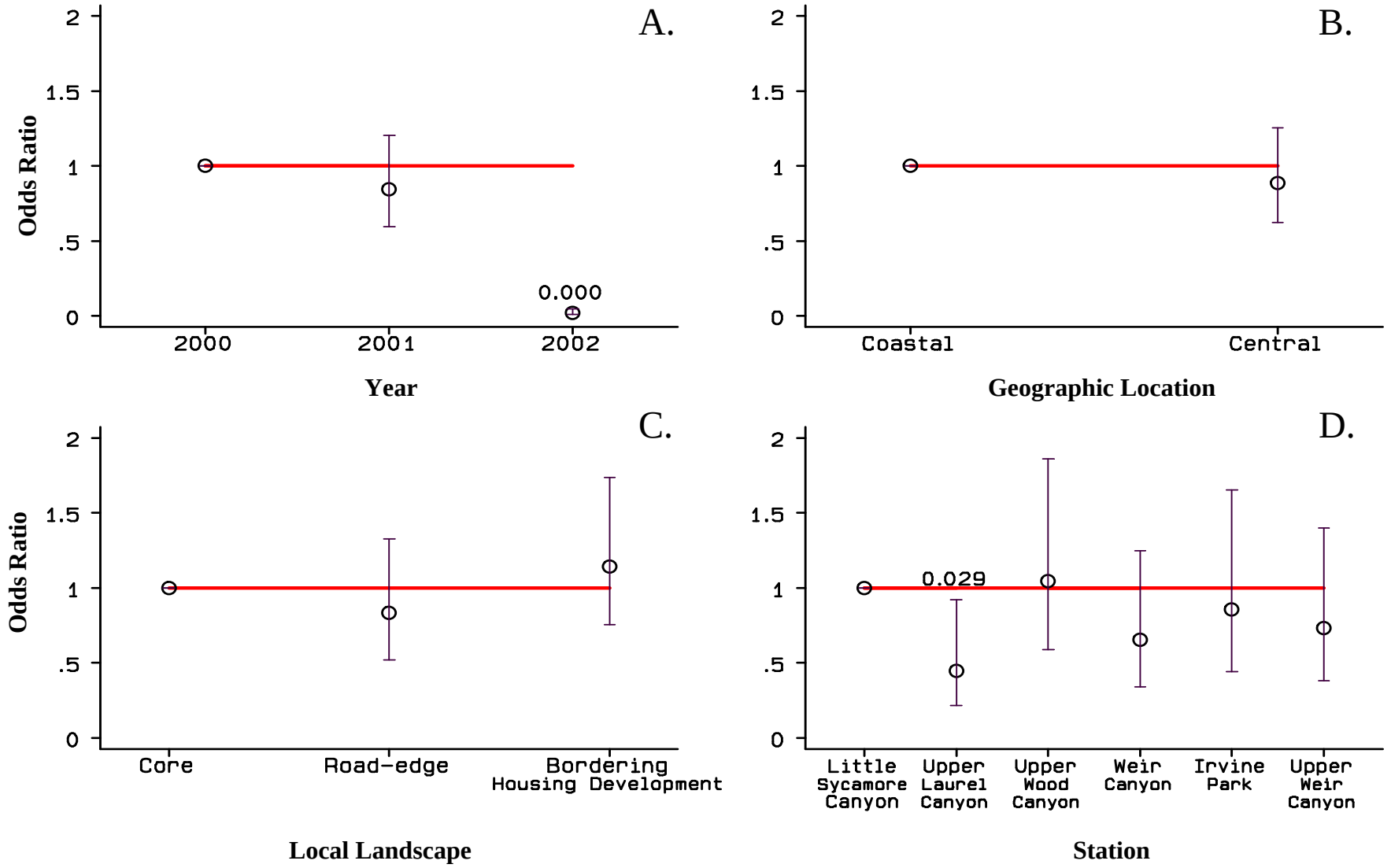


Figure 22. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Wrentit** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

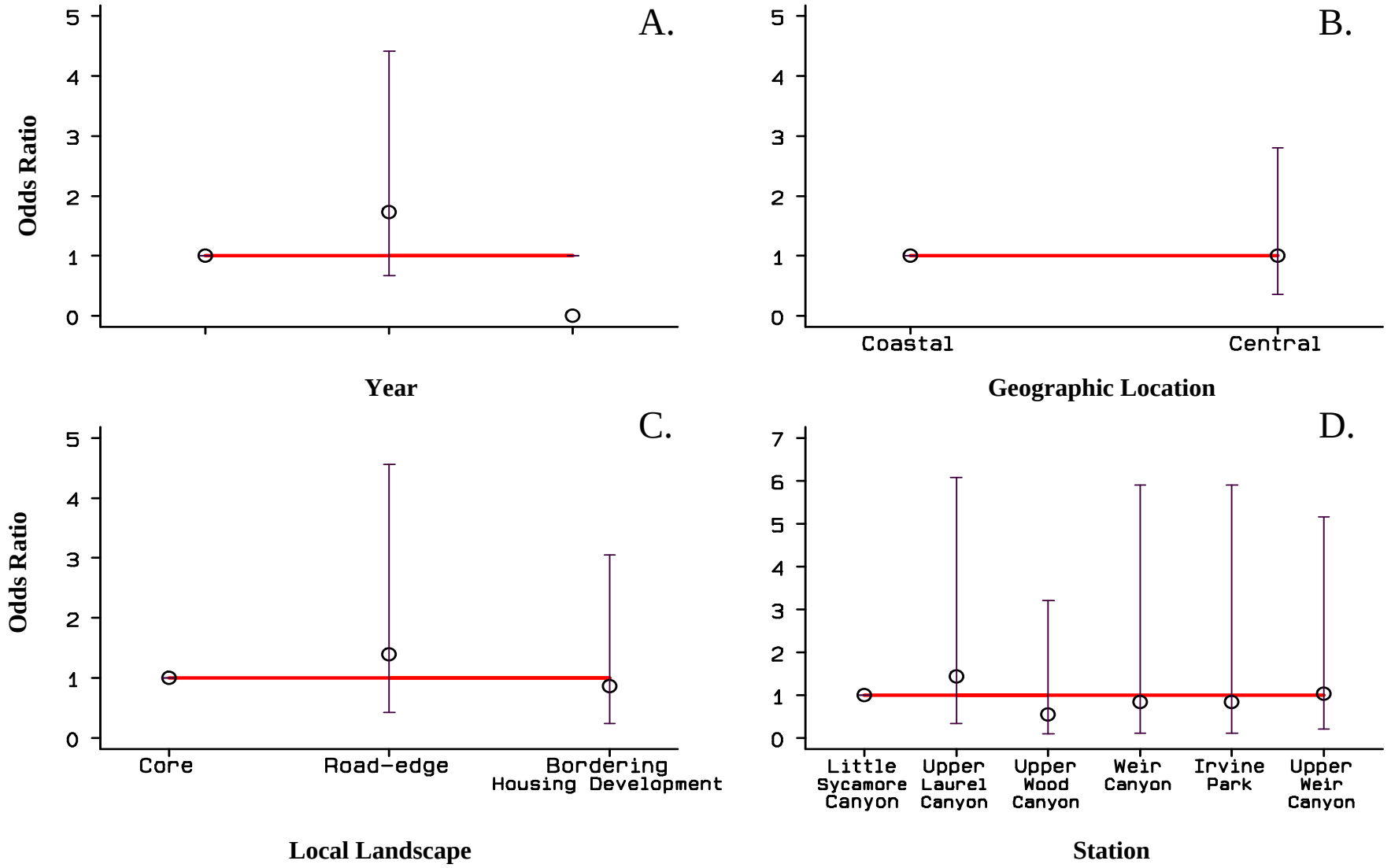


Figure 23. The odds ratios for **productivity indices** (with 95% confidence intervals) for **California Thrasher** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

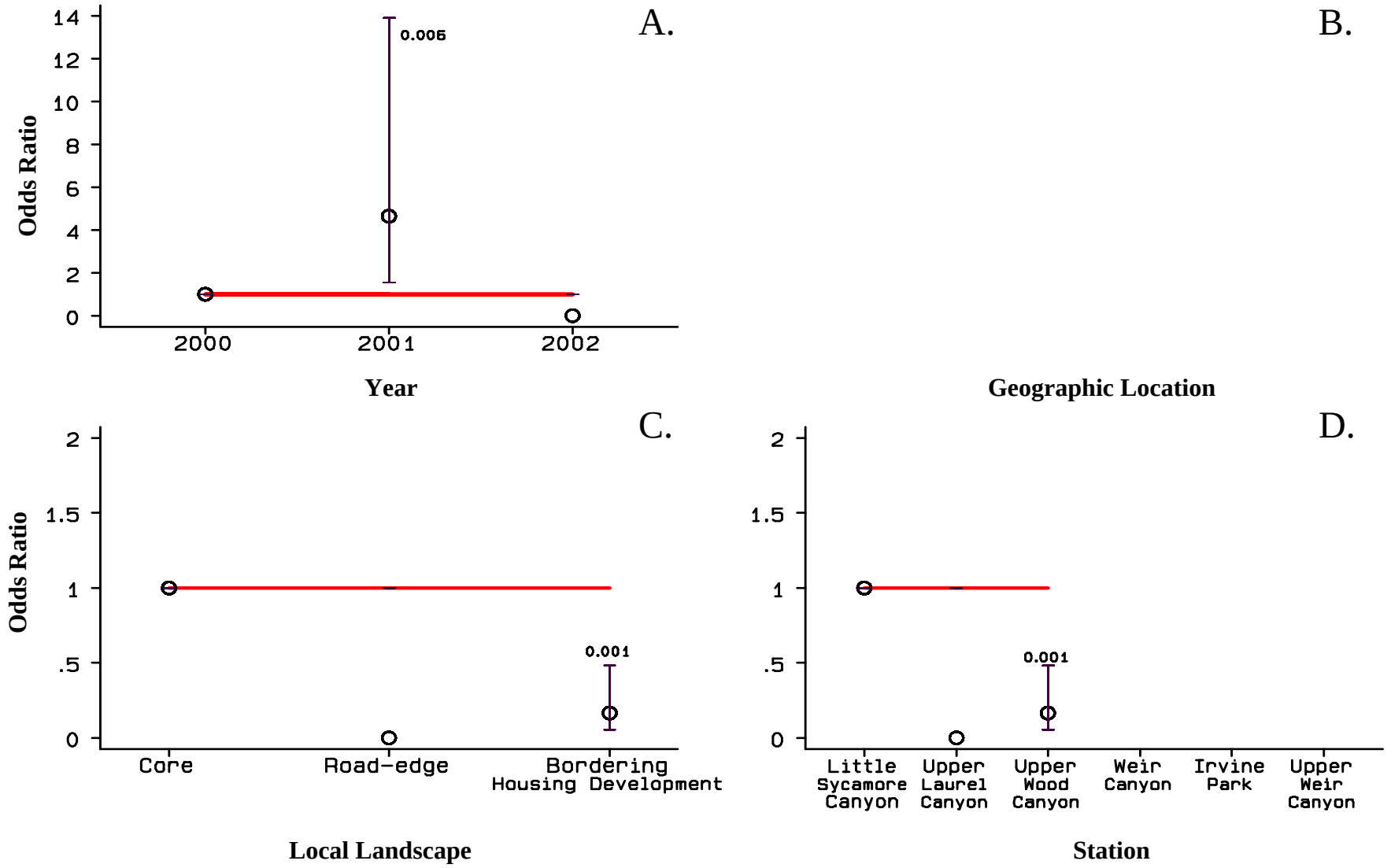


Figure 24. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Orange-crowned Warbler** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

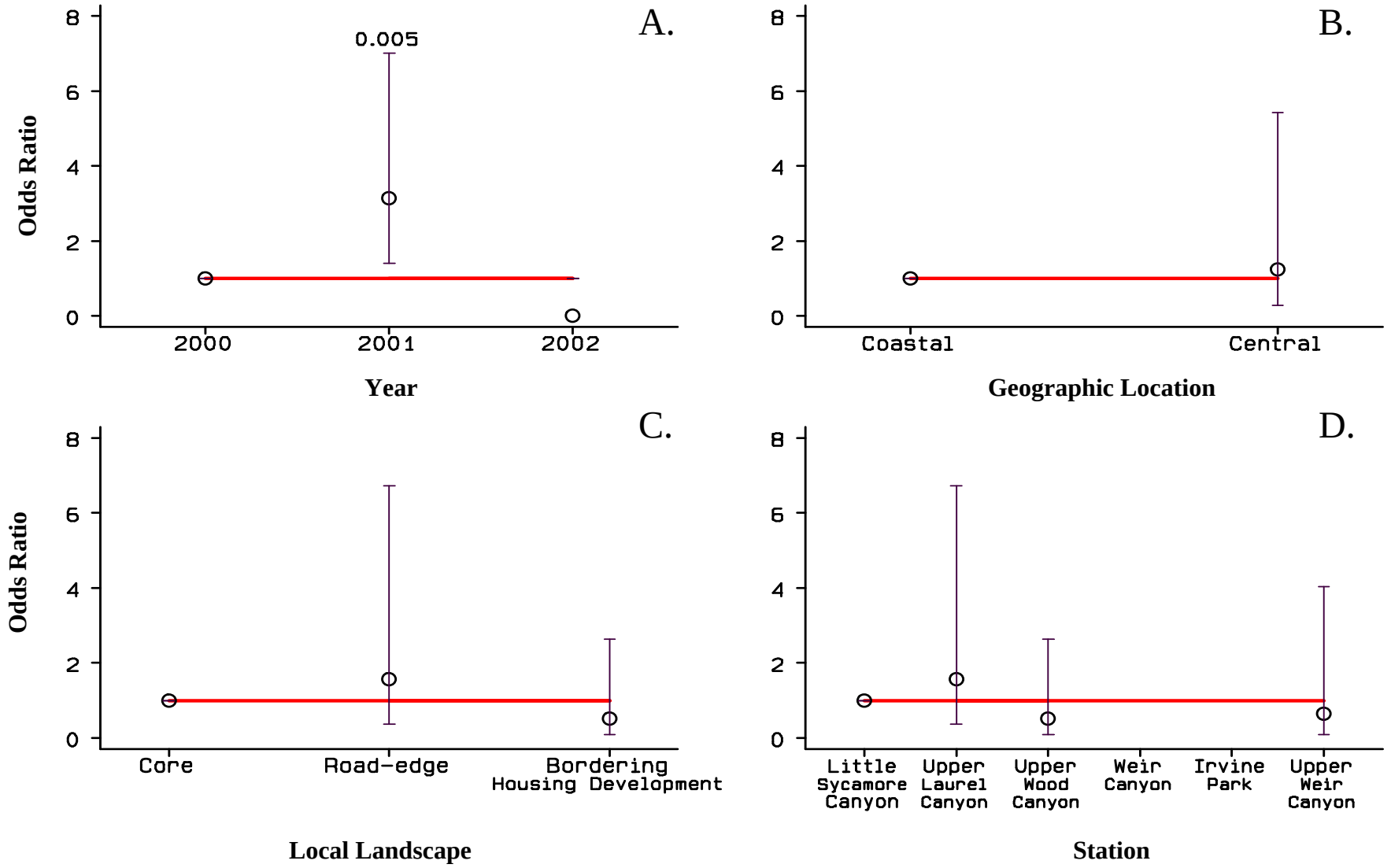


Figure 25. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Common Yellowthroat** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

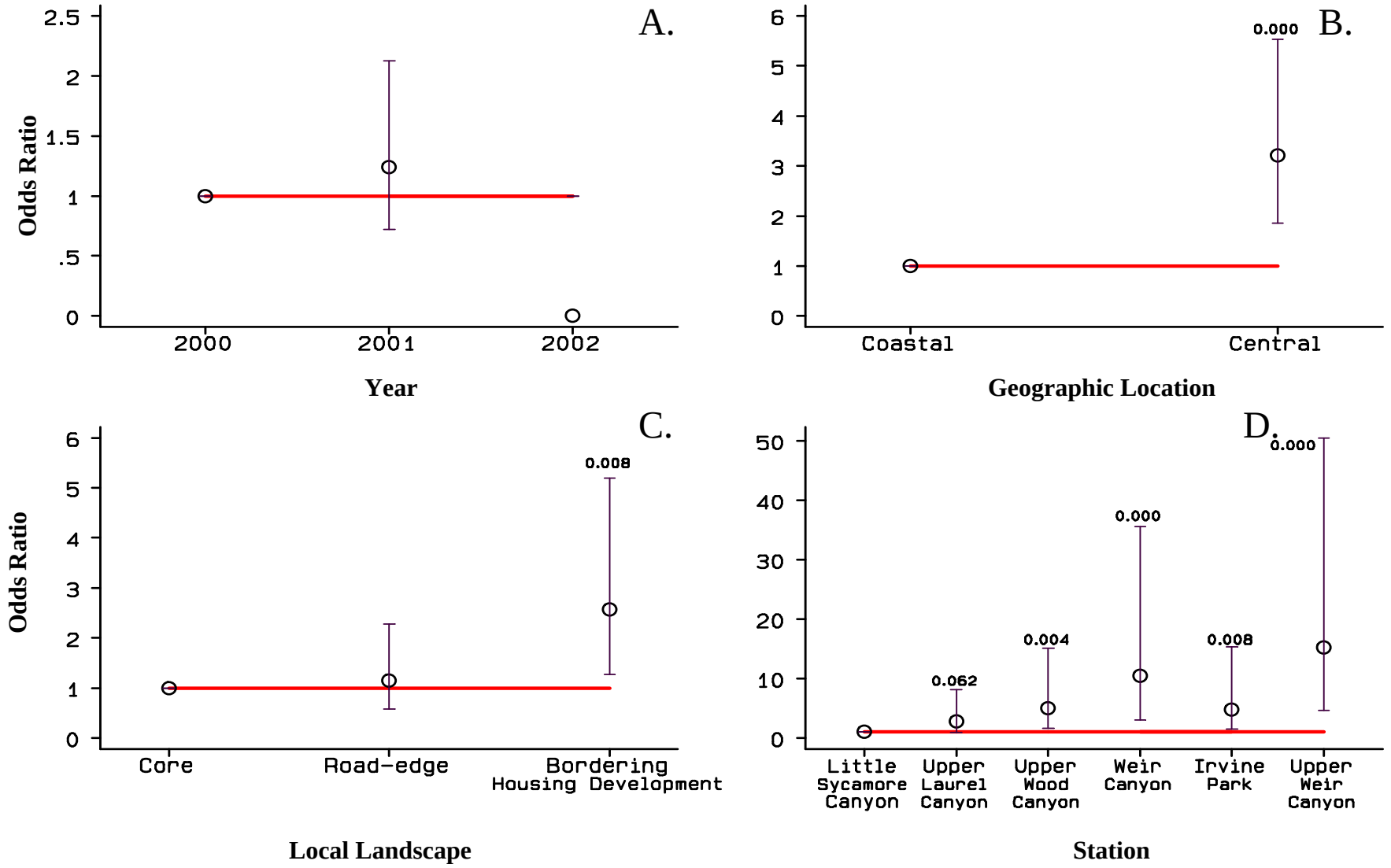


Figure 26. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Spotted Towhee** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

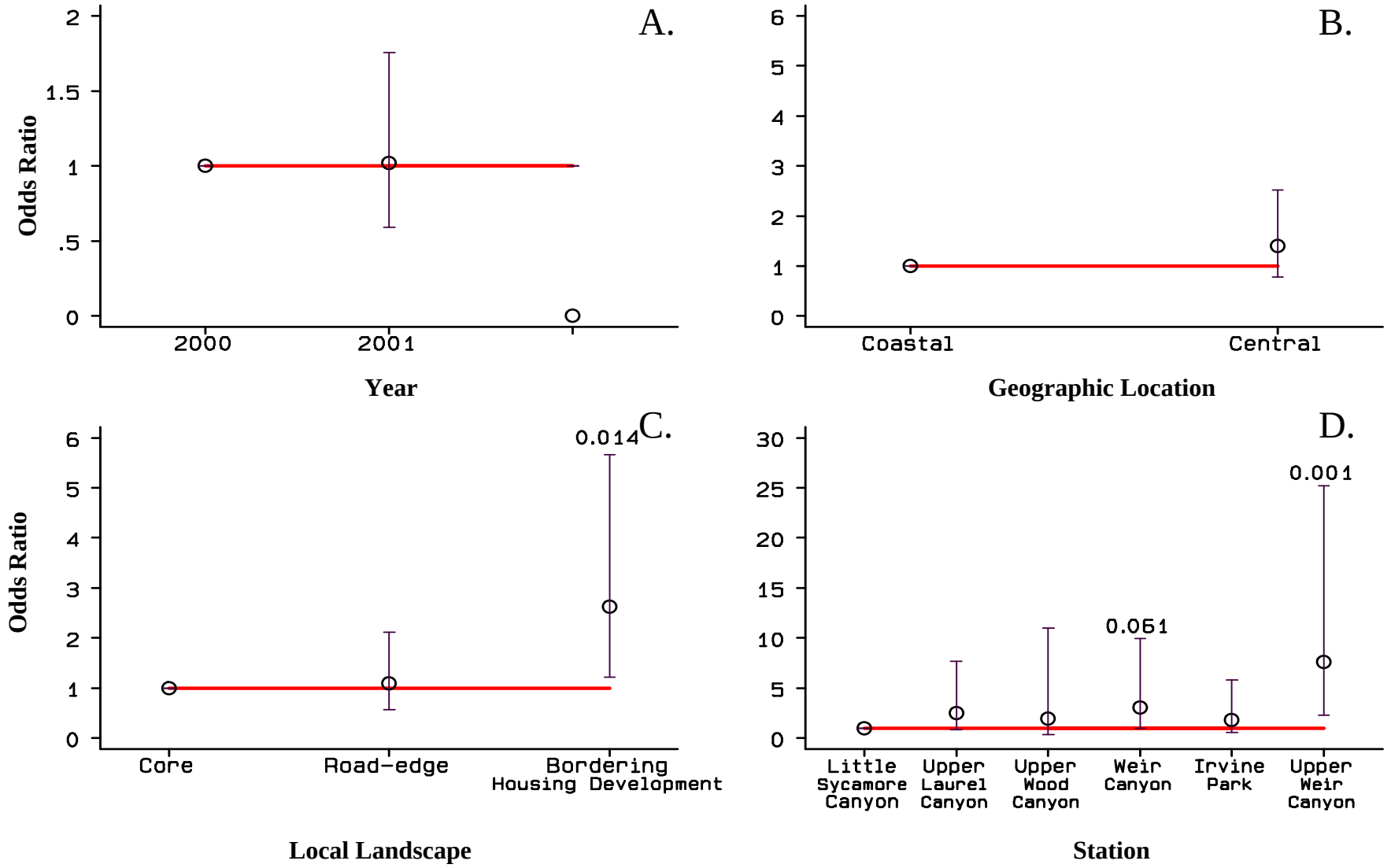


Figure 27. The odds ratios for **productivity indices** (with 95% confidence intervals) for **California Towhee** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

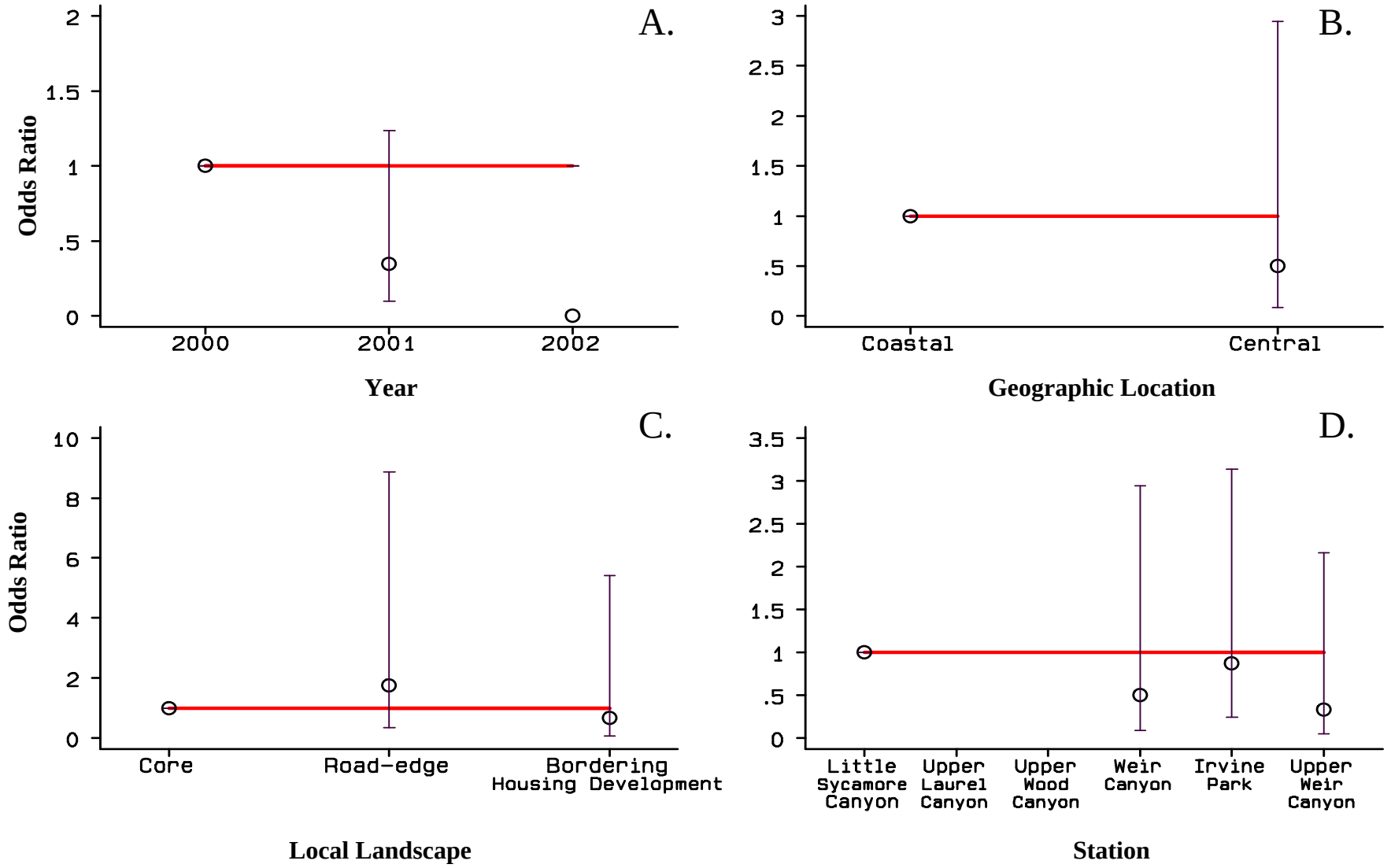


Figure 28. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Rufous-crowned Sparrow** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

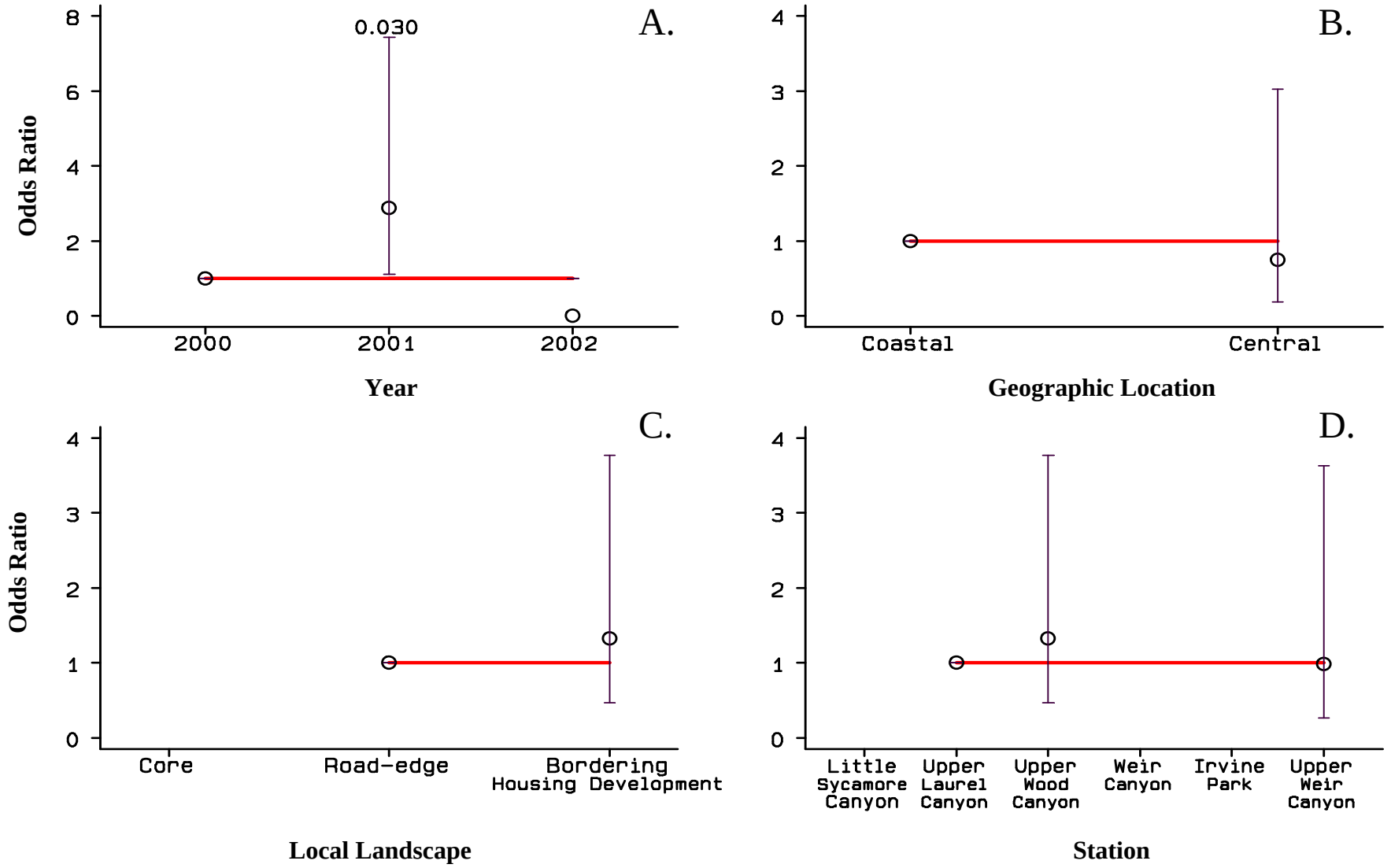


Figure 29. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Song Sparrow** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

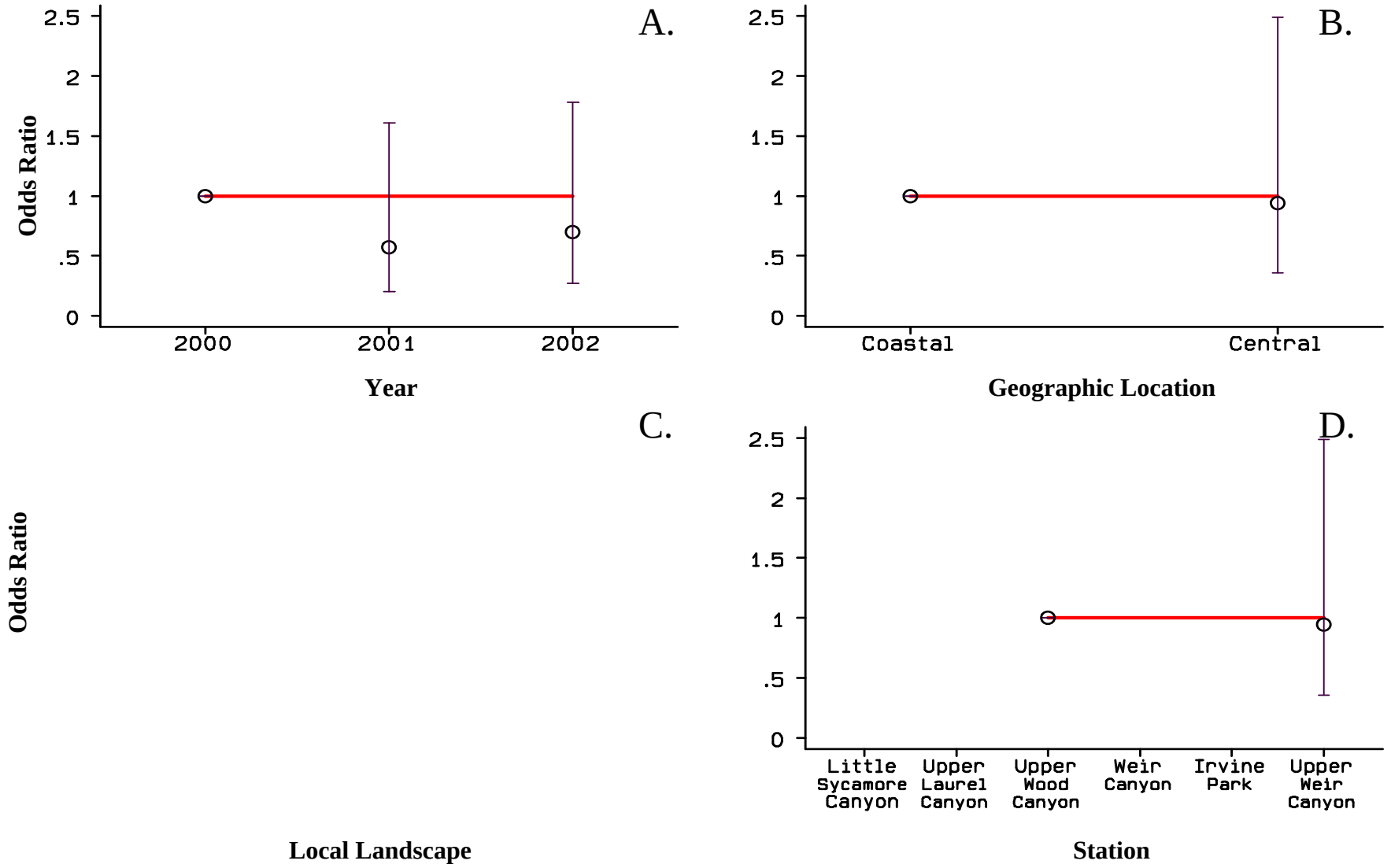


Figure 30. The odds ratios for **productivity indices** (with 95% confidence intervals) for **House Finch** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

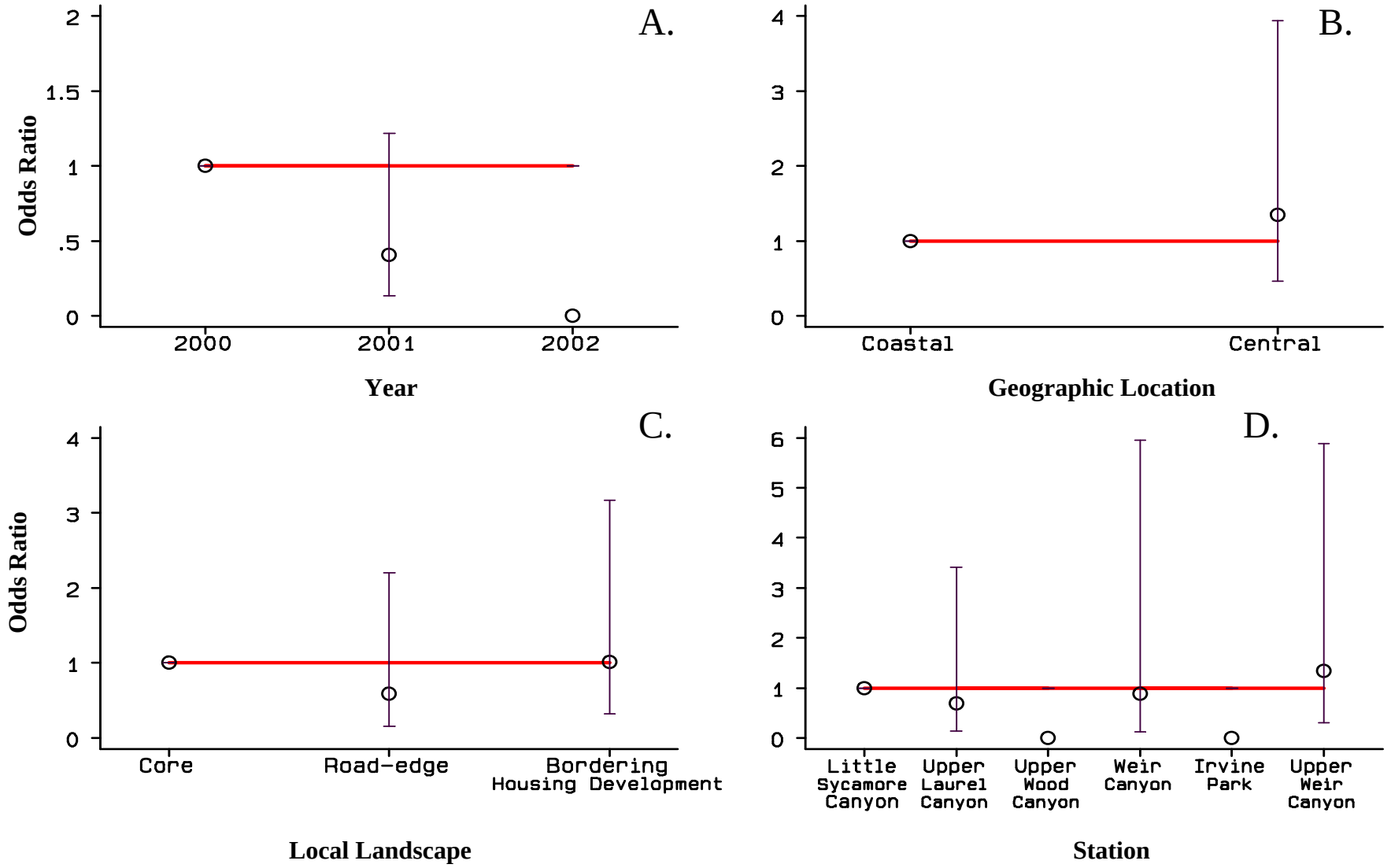


Figure 31. The odds ratios for **productivity indices** (with 95% confidence intervals) for **Lesser Goldfinch** at the Nature Reserve of Orange County for the design variables: A. year; B. geographic location; C. local landscape; and D. station. The odds ratios for each design variable were estimated using multivariate logistic regression. The regressions for graphs A (year), B (geographic location), and C (local landscape) each include the factors year, geographic location, and local landscape. The regression for graph D (station) only includes the factors year and station. For each design variable, the estimated odds ratios are compared to a reference value set at 1.0, and the reference point (lacking a 95% confidence interval) and a reference line are plotted for ease of comparison.

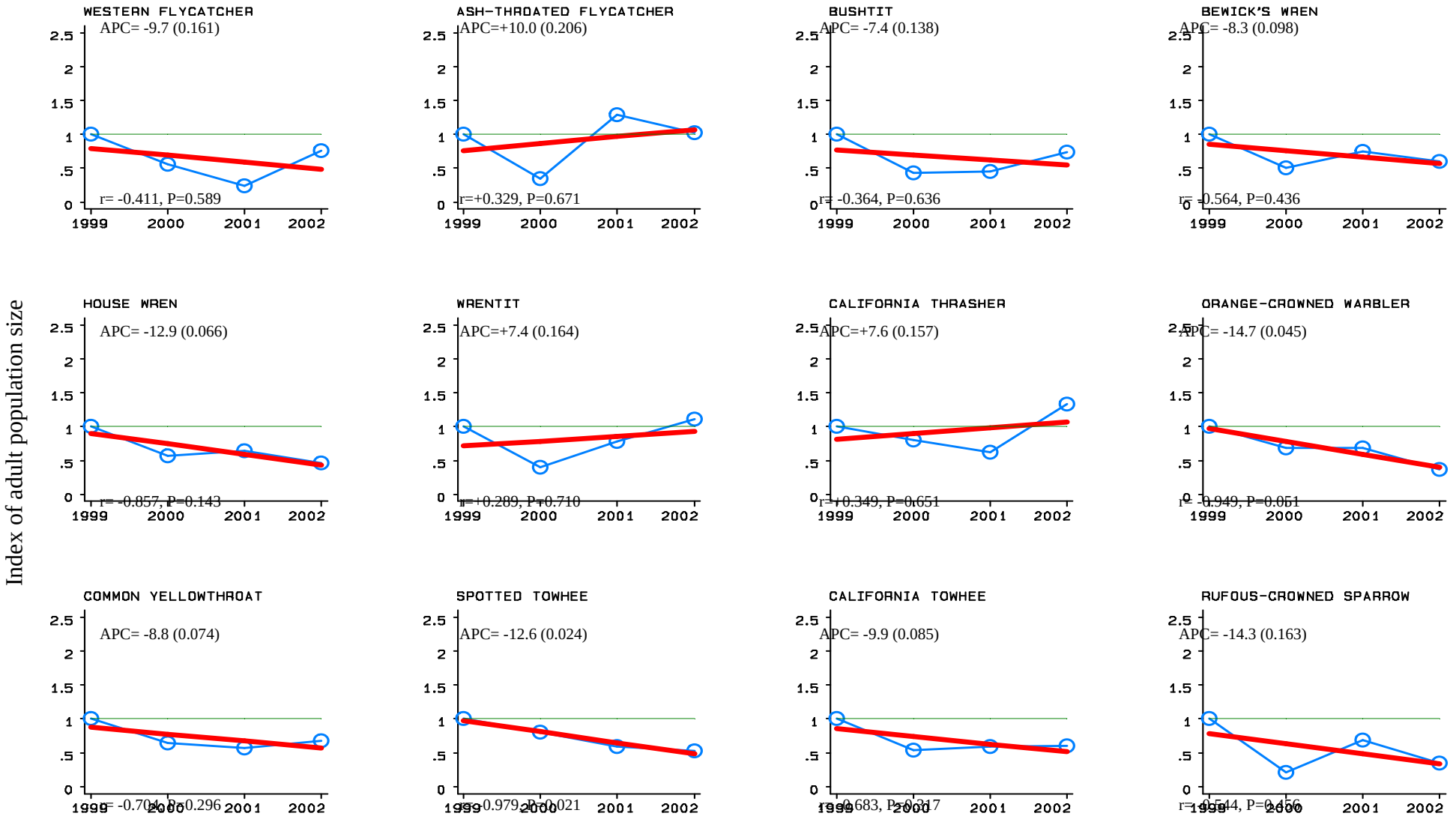


Figure 32. Population trends for 14 species and all species pooled at four MAPS stations (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park) on the Nature Reserve of Orange County over the four years 1999-2002. The index of population size was arbitrarily defined as 1.0 in 1999. Indices for subsequent years were determined from constant-effort between-year changes in the number of adult birds captured from stations where the species was a regular or usual breeder and summer resident. The annual percentage change in the index of adult population size was used as the measure of the population trend (*APC*), and it and the standard error of the slope (in parentheses) are presented on each graph. The correlation coefficient (*r*) and significance of the correlation coefficient (*P*) are also shown on each graph.

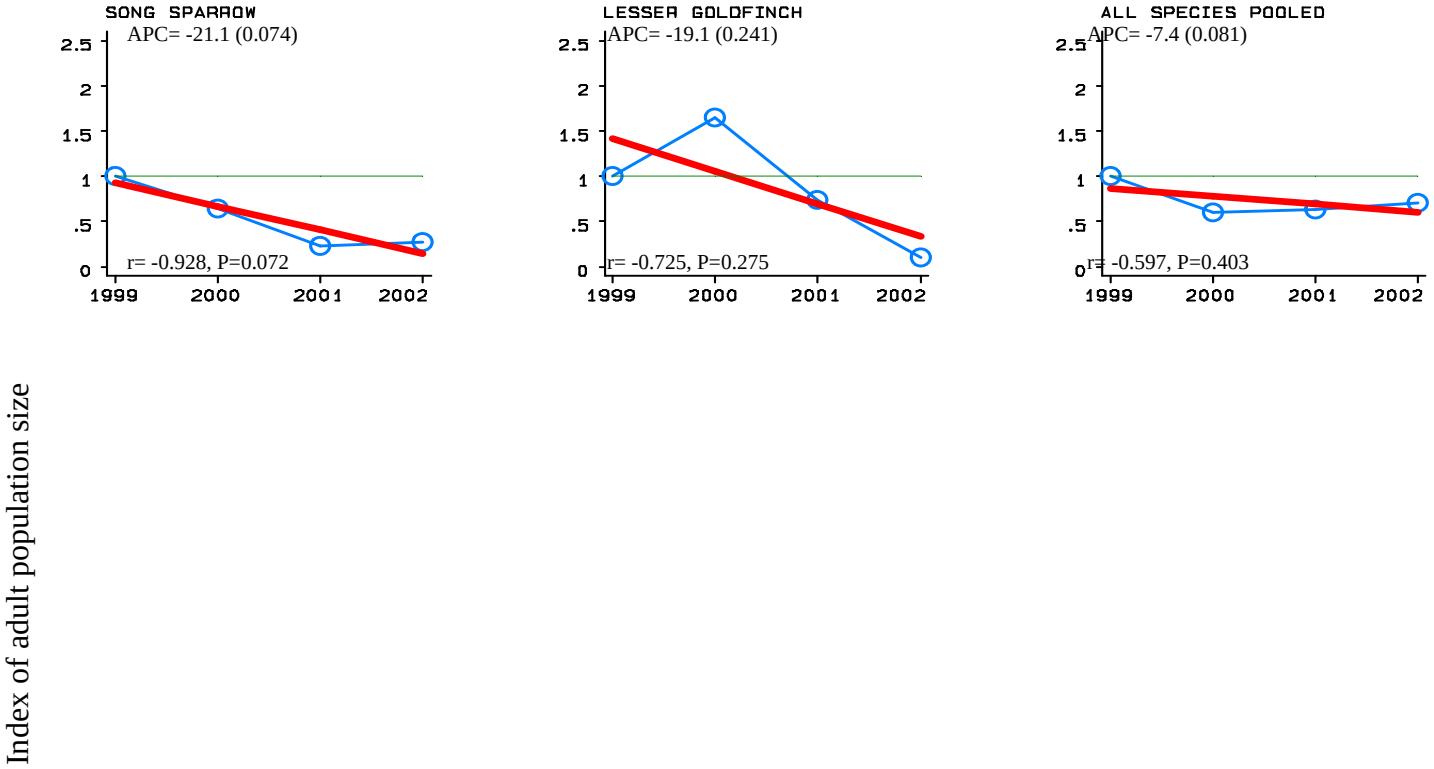


Figure 32. (cont.) Population trends for 14 species and all species pooled at four MAPS stations (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park) on the Nature Reserve of Orange County over the four years 1999-2002. The index of population size was arbitrarily defined as 1.0 in 1999. Indices for subsequent years were determined from constant-effort between-year changes in the number of adult birds captured from stations where the species was a regular or usual breeder and summer resident. The annual percentage change in the index of adult population size was used as the measure of the population trend (*APC*), and it and the standard error of the slope (in parentheses) are presented on each graph. The correlation coefficient (*r*) and significance of the correlation coefficient (*P*) are also shown on each graph.

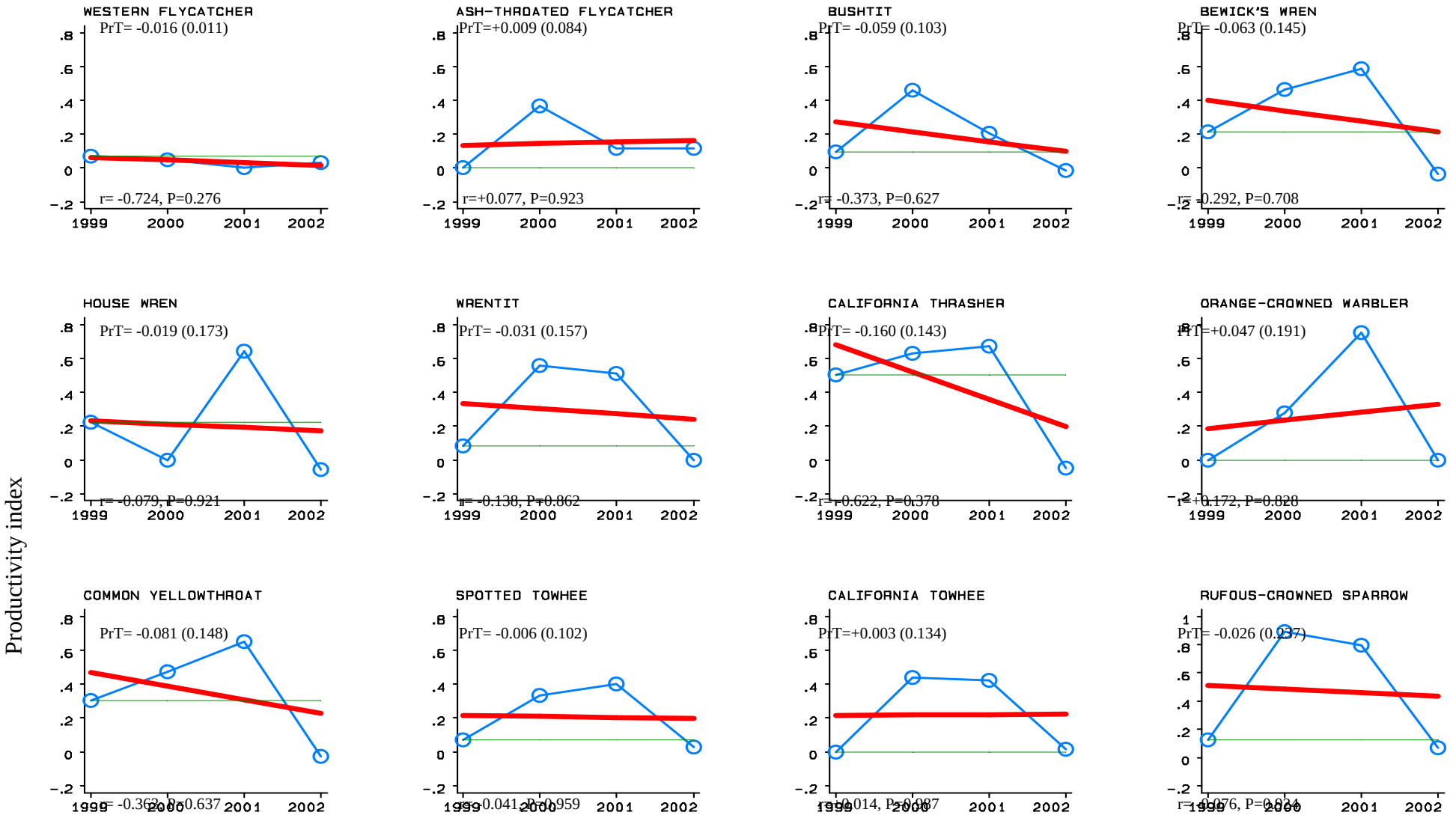
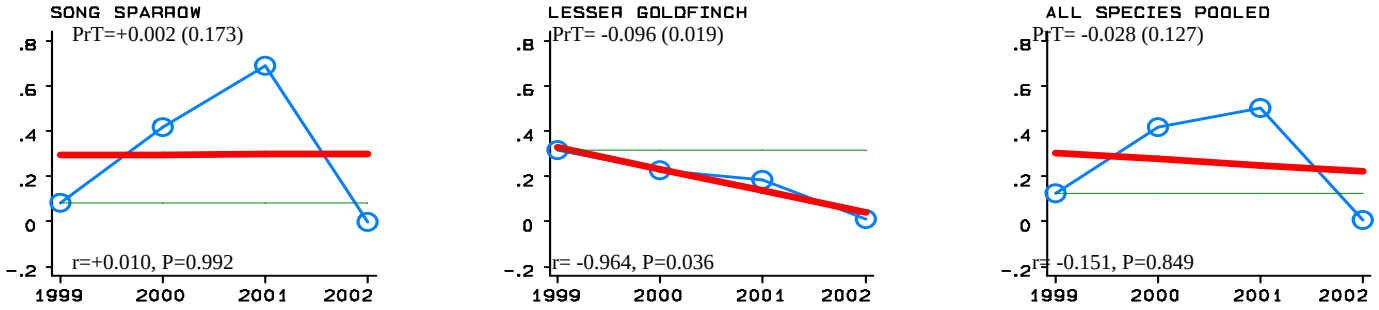


Figure 33. Trend in productivity for 14 species and all species pooled at four MAPS stations (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park) on the Nature Reserve of Orange County over the four years 1999-2002. The productivity index was defined as the actual productivity value in 1999. Indices for subsequent years were determined from constant-effort between-year changes in proportion of young in the catch from stations where the species was a regular or usual breeder and summer resident. The slope of the regression line for annual change in the index of productivity was used as the measure of the productivity trend (*PrT*), and it and the standard error of the slope (in parentheses) are presented on each graph. The correlation coefficient (*r*) and significance of the correlation coefficient (*P*) are also shown on each graph.



Productivity index

Figure 33. (cont.) Trend in productivity for 14 species and all species pooled at four MAPS stations (Little Sycamore Canyon, Upper Laurel Canyon, Weir Canyon, and Irvine Park) on the Nature Reserve of Orange County over the four years 1999-2002. The productivity index was defined as the actual productivity value in 1999. Indices for subsequent years were determined from constant-effort between-year changes in proportion of young in the catch from stations where the species was a regular or usual breeder and summer resident. The slope of the regression line for annual change in the index of productivity was used as the measure of the productivity trend (*PrT*), and it and the standard error of the slope (in parentheses) are presented on each graph. The correlation coefficient (*r*) and significance of the correlation coefficient (*P*) are also shown on each graph.

Appendix I. Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha codes, and species names for all species banded or encountered during the five years, 1998-2002, of the MAPS Program on the ten stations on the Nature Reserve of Orange County.

NUMB	SPEC	SPECIES NAME
NUMB	SPEC	COMMONNAME
00680	BLSP	Black Storm-Petrel
00860	DCCO	Double-crested Cormorant
01010	GBHE	Great Blue Heron
01040	GREG	Great Egret
01080	SNEG	Snowy Egret
01170	BCNH	Black-crowned Night-Heron
01300	TUVU	Turkey Vulture
01630	MALL	Mallard
02070	WTKI	White-tailed Kite
02170	NOHA	Northern Harrier
02210	COHA	Cooper's Hawk
02380	RSHA	Red-shouldered Hawk
02460	RTHA	Red-tailed Hawk
02630	AMKE	American Kestrel
03130	CAQU	California Quail
03780	KILL	Killdeer
04880	CATE	Caspian Tern
05370	RODO	Rock Dove
05440	BTPI	Band-tailed Pigeon
05570	MODO	Mourning Dove
05610	COGD	Common Ground-Dove
06280	LCPA	Lilac-crowned Parrot
06580	GRRO	Greater Roadrunner
06630	BNOW	Barn Owl
06670	WESO	Western Screech-Owl
06800	GHOW	Great Horned Owl
07070	LENI	Lesser Nighthawk
07110	COPO	Common Poorwill
07410	VASW	Vaux's Swift
07530	WTSW	White-throated Swift
08640	BCHU	Black-chinned Hummingbird
08670	ANHU	Anna's Hummingbird
08680	COHU	Costa's Hummingbird
08690	CAHU	Calliope Hummingbird
08730	RUHU	Rufous Hummingbird
08740	ALHU	Allen's Hummingbird
08774	UNSE	Unidentified Selasphorus
08775	UNHU	Unidentified Hummingbird

Appendix I. (cont.) Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha codes, and species names for all species banded or encountered during the five years, 1998-2002, of the MAPS Program on the ten stations on the Nature Reserve of Orange County.

NUMB	SPEC	SPECIES NAME
09430	ACWO	Acorn Woodpecker
09640	NUWO	Nuttall's Woodpecker
09650	DOWO	Downy Woodpecker
09800	RSFL	Red-shafted Flicker
11340	OSFL	Olive-sided Flycatcher
11380	WEWP	Western Wood-Pewee
11475	TRFL	"Traill's" Flycatcher
11475	WIFL	Willow Flycatcher
11510	HAFL	Hammond's Flycatcher
11530	DUFL	Dusky Flycatcher
11555	PSFL	Pacific-slope Flycatcher
11555	WEFL	"Western" Flycatcher
11595	UNEM	Unidentified Empidonax
11600	BLPH	Black Phoebe
11620	SAPH	Say's Phoebe
11740	ATFL	Ash-throated Flycatcher
12000	CAKI	Cassin's Kingbird
12020	WEKI	Western Kingbird
12710	CAVI	Cassin's Vireo
12740	HUVI	Hutton's Vireo
12760	WAVI	Warbling Vireo
13110	WESJ	Western Scrub-Jay
13190	AMCR	American Crow
13300	CORA	Common Raven
13330	HOLA	Horned Lark
13440	VGSW	Violet-green Swallow
13490	NRWS	Northern Rough-winged Swallow
13520	CLSW	Cliff Swallow
13540	BARS	Barn Swallow
13640	OATI	Oak Titmouse
13680	BUSH	Bushtit
13700	WBNU	White-breasted Nuthatch
13830	CACW	Cactus Wren
13850	CANW	Canyon Wren
14040	BEWR	Bewick's Wren
14070	HOWR	House Wren
14350	BGGN	Blue-gray Gnatcatcher
14370	CAGN	California Gnatcatcher
14810	SWTH	Swainson's Thrush

Appendix I. (cont.) Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha codes, and species names for all species banded or encountered during the five years, 1998-2002, of the MAPS Program on the ten stations on the Nature Reserve of Orange County.

NUMB	SPEC	SPECIES NAME
14820	HETH	Hermit Thrush
15000	AMRO	American Robin
15110	WREN	Wrentit
15150	NOMO	Northern Mockingbird
15270	CATH	California Thrasher
15370	EUST	European Starling
15550	CEDW	Cedar Waxwing
15590	PHAI	Phainopepla
15660	OCWA	Orange-crowned Warbler
15670	NAWA	Nashville Warbler
15750	YWAR	Yellow Warbler
15810	BTYW	Black-throated Gray Warbler
15840	TOWA	Townsend's Warbler
15845	THWH	Townsend's x Hermit Warbler Hybrid
15850	HEWA	Hermit Warbler
16140	MGWA	MacGillivray's Warbler
16150	COYE	Common Yellowthroat
16290	WIWA	Wilson's Warbler
16460	YBCH	Yellow-breasted Chat
16840	WETA	Western Tanager
17790	GTTO	Green-tailed Towhee
17810	SPTO	Spotted Towhee
17850	CALT	California Towhee
17950	RCSP	Rufous-crowned Sparrow
18020	CHSP	Chipping Sparrow
18070	BCSP	Black-chinned Sparrow
18090	LASP	Lark Sparrow
18140	GRSP	Grasshopper Sparrow
18230	SOSP	Song Sparrow
18240	LISP	Lincoln's Sparrow
18290	WCSP	White-crowned Sparrow
18300	GCSP	Golden-crowned Sparrow
18335	UNSP	Unidentified Sparrow
18600	RBGR	Rose-breasted Grosbeak
18610	BHGR	Black-headed Grosbeak
18640	BLGR	Blue Grosbeak
18660	LAZB	Lazuli Bunting
18730	RWBL	Red-winged Blackbird
18810	WEME	Western Meadowlark

Appendix I. (cont.) Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha codes, and species names for all species banded or encountered during the five years, 1998-2002, of the MAPS Program on the ten stations on the Nature Reserve of Orange County.

NUMB	SPEC	SPECIES NAME
18960	BHCO	Brown-headed Cowbird
19050	HOOR	Hooded Oriole
19170	BUOR	Bullock's Oriole
19350	PUFI	Purple Finch
19370	HOFI	House Finch
19490	LEGO	Lesser Goldfinch
19500	LAGO	Lawrence's Goldfinch
19510	AMGO	American Goldfinch
19920	HOSP	House Sparrow