THE 2005 ANNUAL REPORT OF THE MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM ON THE FLATHEAD RESERVATION OF THE CONFEDERATED SALISH AND KOOTENAI TRIBES

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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 nearly 500 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 annual estimates of adult survivorship, recruitment into the adult population, and population growth rates at multiple spatial scales for many 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 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 in local areas, such as Indian reservations, federally managed public (e.g., national forests, national parks, military installations) or private lands. In this vein, it is expected that population and demographic data on the landbirds found on the Flathead reservation (or any other given tract of land) will aid research and management efforts on the Reservation (or other lands) to protect and enhance the Reservation's avifauna and ecological integrity while allowing it to serve its multi-use purposes. More specific objectives include (1) the determination of proximate causes of declining trends, (2) the comparison of managed and unmanaged sites, and (3) recommendation of further management guidelines.

We operated six MAPS stations in 2005 on the Flathead Reservation, in the same locations in which they were first established in 1993 (Crow Creek and Safe Harbor Marsh stations), 2002 (Jocko River station), and 2003 (Woodpecker Haven, Schall, and Spring Creek stations), and operated through 2004. With few exceptions, the ten net sites per station were operated for six morning hours per day on one day per 10-day period, and for seven consecutive 10-day periods between May 31 and August 8. A total of 800 captures of 45 landbird species was recorded at the six stations during the summer of 2005.

Constant-effort comparisons indicated that both population sizes and productivity of breeding landbirds decreased significantly at Flathead Reservation between 2004 and 2005 after similar declines were noted between 2003 and 2004. This is an unusual observation among MAPS data and suggesting anomalous weather patterns during 2005. Indeed, the season was extremely dry except for a major rainstorm during the first few days of June, which flooded MAPS stations and was thought to have affected reproductive success. Given the density dependent effects that are commonly observed and assuming typical weather in 2006 we might expect to see very low breeding populations (because of the lack of recruitment of one-year-old birds) but much higher productivity (due to lack of competition).

Multivariate analyses suggested that adult population sizes and (especially) productivity were higher at managed stations than at unmanaged stations after controlling for year- and effort-effects. This is very promising news concerning management efforts along the Jocko River, and we hope that, as the restoration efforts reach maturity, these favorable results will strengthen.

Thirteen-year (1993-2005) analyses at Flathead indicate a substantial and nearly significant decline of adults captured and a non-significant long-term decline in productivity. A primary goal of the MAPS program is to determine proximate causes (productivity or survival) of declines in landbird population sizes. A comparison of productivity indices and survival rate estimates from Flathead to those calculated from data collected across the Northwest Region suggests that low productivity, rather than low survival was the proximate cause of observed declines at Flathead.

Survival of 14 target species (data pooled across species) at Flathead (0.495 for all years 1993-2005) was very similar to survivorship for these species across the entire region during a similar time period (0.497 from 1992-2001; regional data available at http://www.birdpop.org/nbii/NBIIHome.asp). Productivity, however, differed markedly between Flathead (0.30) and the entire Northwest Region (0.57) for the same set of species and years. Furthermore, productivity of 11 of the 14 target species was substantially lower ($\geq$ 20%) at Flathead than in the Northwest Region. Only one species had substantially higher (36%) productivity at Flathead than for the entire region: Brown-headed Cowbird. These results strongly suggest that landbird productivity is deficient at Flathead and may be due to high levels of cowbird nest parasitism. High levels of livestock agriculture in the region may be enhancing cowbird habitat and may be helping to keeping riparian habitats open and accessible to cowbirds seeking hosts.

Three species declined substantially at Flathead over the 13 years (1993-2005): "Traill's" Flycatcher, Common Yellowthroat, and Song Sparrow. Two of these three species, "Traill's" Flycatcher and Song Sparrow, showed substantially lower productivity at Flathead than in the Northwest overall, indicating that low productivity may be driving or contributing substantially to population declines. Both species are common Brown-headed Cowbird hosts, further suggesting that parasitism may be a problem for landbirds at Flathead. Increasing riparian patch sizes at Flathead, as currently being undertaken, will increase nest cover and decrease edge habitat, which in turn should help reduce parasitism by cowbirds.

We have recently found that patterns of landscape structure within 2-4 km of a MAPS station are good predictors, not only of the numbers of birds of each species captured but, more importantly, of their productivity levels as well. At Flathead Reservation, we anticipate using habitat modeling to assess effects of habitat restoration both at the local scale (as correlated with planned revegetation and stream restoration) and at the landscape level (as related to the sizes of continuous patches that occur along the Jocko River).

An important objective of the MAPS Program is to identify generalized management guidelines and formulate specific management actions that can be implemented to reverse the population declines of target landbird species and to maintain the populations of stable or increasing species. This objective will be achieved by modeling the vital rates (productivity and survivorship) of the various landbird species as a function of landscape-level habitat characteristics and spatially explicit weather variables. Management strategies will involve efforts to modify the habitat from characteristics associated with low productivity to those associated with high productivity.

The 13 years of MAPS data collected at the Flathead Reservation provides an important baseline for tribal land managers. Insights provided by these data into changes in landbird populations and their demographics underscore the importance of such long-term monitoring. We anticipate that riparian restoration efforts, if continued, will enhance local productivity and population sizes on the reservation. Nevertheless, only through continued monitoring can such population benefits be documented. Although funding cuts may curtail our ability to document these changes in the short-term, we hope to revisit these stations in the future with the goal of collecting additional data to be used for constructing general models of bird responses to restoration efforts. Achieving this goal will aid land managers at both Flathead and at other managed land holdings in western North America.

INTRODUCTION

The Flathead Reservation of the Confederated Salish and Kootenai Tribes has taken on the responsibility for managing the natural resources on their lands in such a manner that, to the extent possible considering the multi-use purposes of these lands, maintains the ecological integrity and species diversity of the ecosystems present on these lands, and conserves them unimpaired for future generations. In order to successfully carry out these responsibilities, integrated long-term programs are needed to monitor the natural resources on the Reservation and to monitor the effects of varying management practices and restoration efforts on those resources.

The development and implementation of effective long-term biomonitoring programs on the Reservation can be of even wider importance than aiding the Tribes in the management of their natural resources. Because tribal lands provide large areas of multiple ecosystems subject to varying management practices, studies conducted on these lands can provide invaluable information for understanding natural ecological processes and for evaluating the effects of both local and large-scale, even global, environmental changes. Thus, long-term monitoring data from reservations can provide information that is crucial for efforts to preserve natural resources and biodiversity on a regional or even continental scale.

Landbirds

Landbirds, because of their high body temperature, rapid metabolism, and high trophic position on most food webs, are 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 populations and demographic parameters. It is not surprising, therefore, that landbirds have been selected by the Tribes 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-inhabiting 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 (species 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.

Primary Demographic Parameters

Existing population-trend data on Neotropical migrants, 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). In particular, 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.

The MAPS Program

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 and effectiveness for monitoring demographic parameters of landbirds. A peer review of the 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 17th year (14th year of standardized protocol and extensive distribution of stations), the MAPS program has expanded greatly from 178 stations in 1992 to nearly 500 stations in 2005. The substantial growth of the Program since 1992 was caused by its endorsement by PIF and the subsequent involvement of various federal agencies in PIF, including the USDA Forest Service, National Park Service, Department of Defense, Department of the Navy, Texas Army National Guard, and US Fish and Wildlife Service, and The Flathead Reservation of the Confederated Salish and Kootenai Tribes. Within the past ten years, for example, IBP has been contracted to operate over 150 MAPS stations on federal lands, including six stations on the Flathead National Forest and six stations on the Flathead Reservation.

Objectives of MAPS
MAPS is organized to fulfill three tiers of 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 (CJS) 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.

MAPS aims to achieve these goals by means of long-term monitoring at two major spatial scales. The first scale is very large – effectively the entire North American continent divided into eight geographical regions. It is envisioned that tribal reservations, along with national forest lands, national parks, DoD military installations, and other public lands, can provide a major subset of sites for this large-scale objective. The second, smaller spatial scale includes specific geographical areas (perhaps based on physiographic strata or Bird Conservation Regions) or locations (such as individual tribal reservations, national forests, national parks, or military installations) to aid research and management within these relatively local areas. The sampling strategy utilized at these smaller scales should be hypothesis-driven and integrated with other research and monitoring efforts.

Recent Important Results from MAPS

Recent important findings from MAPS include the following. (1) Age ratios obtained during late summer, population-wide mist netting provided a good index to actual productivity in the Kirtland's Warbler (Bart et al. 1999). (2) Measures of productivity and survival derived from MAPS data were consistent with observed population changes at multiple spatial scales (DeSante et al. 1999). (3) Patterns of productivity from MAPS at two large spatial scales (eastern North America and the Sierra Nevada) not only agreed with those found by direct nest monitoring and those predicted from theoretical considerations, but were in general agreement with current life-history theory and were robust with respect to both time and space (DeSante 2000). (4) Modeling spatial variation in MAPS productivity indices and survival-rate estimates as a function of spatial variation in population trends provides a successful means for identifying the proximate demographic cause(s) of population change at multiple spatial scales (DeSante et al. 2001). (5) Productivity of landbirds breeding in Pacific Northwest national forests is affected by global climate cycles including the El Niño Southern Oscillation and the North Atlantic Oscillation, in such a manner that productivity of Neotropical migratory species is determined more by late winter and early spring weather conditions on their wintering grounds than by late spring and summer weather conditions on their breeding grounds (Nott et al. 2002). (6) Analyses describing relationships between four demographic parameters (adult population size, population trend, number of young, and productivity) and landscape-level habitat characteristics for bird species of conservation concern have been completed for 13 military installations in south-central and southeastern United States, allowing conservation management strategies to be formulated and tested (Nott et al. 2003a). (7) Analyses describing relationships between demographic parameters and landscape-level habitat characteristics for bird species of conservation concern have also been completed for 16 species inhabiting six Region-6 National Forests in Washington and Oregon (Nott et al. 2005). (Most or all of these reports or publications are available at the Institute for Bird Populations' website: http://www.birdpop.org/publications.htm) These results indicate that MAPS is capable of achieving, and in some cases is already achieving, its goals.

The MAPS Program on the Flathead Reservation

All three of the objectives of MAPS, as described above, agree with those of the Flathead Reservation. Accordingly, the MAPS Program was initiated on the Flathead Reservation in 1993, with two stations being established there, to accompany six stations established in 1992 on the nearby Flathead National Forest. The overall goal of the initial establishment of the MAPS

program on the Flathead National Forest and Flathead Reservation was to provide high quality information on the demographics of landbirds that could be used to aid research and management efforts on the forest and reservation to protect and enhance the avifauna and ecological integrity, while allowing them each to fulfill their multi-use purposes.

A more recently defined objective of MAPS is to evaluate the success of on-going management actions, such as habitat and stream restoration and fire-ecology management. At Flathead Reservation, we had the opportunity to pursue this objective in 2003 when the Flathead Tribe began efforts to restore habitat in the Jocko River watershed. These efforts are aimed at re-channeling the river to it's original banks and restoring the cottonwood/willow riparian habitat, which has been reduced during the past 100 years by grazing and development from a continuous strip to small patches. In 2002-2003, four new stations were established in areas subject to on-going and future habitat restoration efforts in the Jocko River watershed. At the Schall station, an old homestead and associated exotic plantings were removed during the spring of 2003, and the area was tilled and replanted with native grassland species. At Jocko River, revegetation efforts commenced during the fall of 2003 with the planting of seedling willows and cottonwoods. These seedlings were successfully transplanted resulting in low developing shrubs during the 2004 MAPS season. At Woodpecker Haven, active and substantial revegetation and stream restoration occurred upstream of the station in 2004-2005. Similar restoration is planned for the vicinity of the Spring Creek station in future years. Thus, the current and future goals of the MAPS program on Flathead Reservation are to continue the long-term objectives described above as well as to monitor the effects of activities aimed at restoring the Jocko River watershed.

The 2005 Report

Here we summarize results of the MAPS program at six stations on the Flathead Reservation from 1993 through 2005. For each station and for all six stations pooled, we present indices of adult population size and productivity and present constant-effort changes between 2004 and 2005 in the numbers of adult birds captured (an index of adult population size), the numbers of young birds captured, and the number of young captured per adult captured (an index of productivity). We present assessments of the effects of restoration at the Schall and Jocko River stations. Based on data from the two long-running stations, we also present 13-year means for the indices of adult population size and productivity for each species and for all species pooled, 13-year trends in adult population size and productivity for a group of target species and for all species pooled, and estimates of annual adult survivorship for those target species. Using multivariate logistic regression analyses we examine variation in population size and productivity by year, station, habitat type, and management activity. Using these data, we then (1) identify landbird species that are declining on the Flathead Reservation, as well as species that are increasing; (2) identify probable proximate demographic causes (low productivity or low adult survival) for these population changes; and (3) assess the effects of management activities on increasing the health of landbird population in the Jocko River watershed.

METHODS

Six 20-ha MAPS stations were re-established on Flathead Reservation in 2005, at the same locations at which they were originally established. In order of decreasing elevation the six stations are: (1) Woodpecker Haven, established in 2003 along the Jocko River (across from the Arlee Fish Hatchery); (2) Safe Harbor Marsh, established in 1993 in mixed coniferous forest near a freshwater marsh; (3) Schall, established in 2003 in degraded habitat at 870 m elevation along the Jocko River; (4) Spring Creek, established in 2003 at the junction of Jocko River and Spring Creek; (5) Jocko River, established in 2002 at a restoration site along the Jocko River; and (6) Crow Creek, established in 1993 in a mixed pine and riparian forest. Four of the stations were located in cottonwood/willow riparian habitat: Woodpecker Haven, Schall, Spring Creek, and Jocko River. Restoration efforts have occurred at the Jocko River and Schall stations and are planned for the Woodpecker Haven and Spring Creek stations (see above). The remaining two stations were located in habitats with a greater coniferous component.

The six stations were operated in 2005 by two field biologist interns of The Institute for Bird Populations (IBP; Nicholle Stephens and Rebecca Schiewe), who received intensive training from IBP staff field biologists Tim Pitz and Ron Taylor and were supervised through the season by IBP biologist Nicole Michel. On each day of operation, one 12-m long, 30-mm mesh, 4-tier nylon mist net was erected at each of ten fixed net sites within the interior 8 ha of each station. These ten nets at each station were operated for six morning hours per day (beginning at local sunrise), and for one day in each of seven consecutive 10-day periods between May 31 and August 3. With few exceptions, the operation of all stations occurred on schedule in each of the ten-day periods.

The operation of each of the six stations during 2005, and during all preceding years, followed the highly standardized protocols developed by IBP (DeSante et al. 2005; available at http://www.birdpop.org/MANUALS.HTM). An overview of 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 rainfall. The following data were taken on all birds captured, including recaptures, according to MAPS guidelines using standardized codes and forms (DeSante et al. 2005; available at http://www.birdpop.org/MANUALS.HTM):

(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., extent of 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) presence of molt limits and plumage characteristics;
(12) wing chord;
(13) fat class and body mass;
(14) date and time of capture (net-run time);
(15) station and net site where captured; and
(16) any pertinent notes.

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.

We prepared simple habitat maps for each station that delineated habitat types (maximum of four), buildings, roads, trails, and streams; 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 detailed in the MAPS Habitat Structure Assessment Protocol (Nott et al. 2003b; available at http://www.birdpop.org/MANUALS.HTM).

Computer Data Entry and Verification

Computer entry of banding data was completed by John W. Shipman of Zoological Data Processing, Socorro, NM. 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, breeding status, 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 effort and breeding status 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.

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 on their breeding (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 or mean population size and productivity analyses for the species unless the species was classified as a migrant (M) at the station. For survivorship estimates and population size and productivity trends, 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 at the station. Throughout this report we define "target species" as those for which an average of 2.5 individual adult birds were captured per year at all stations combined or at each station for station-specific analysis. For survivorship analysis an additional requirement was that at least two returns were recorded at all stations combined.

A. Population-size and productivity analyses – The proofed, verified, and corrected banding data from 2005 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 2005) of individual adult and young birds; and
(3) the reproductive index.

Following procedures pioneered by the British Trust for Ornithology (BTO) in their CES Scheme (Peach et al. 1996), we used the number of adult birds captured as an index of adult population size. For our estimate of post-fledging productivity, we are now using "reproductive

index" (number of young divided by number of adults) as opposed to "proportion of young in the catch" previously used. Reproductive index is a more intuitive value for productivity, and it is also more comparable to other calculated MAPS parameters such as recruitment indices.

For each station and for all six stations combined, we calculated percent changes between 2004 and 2005 in the numbers of adult and young birds captured and actual changes between the two years in post-fledging productivity (reproductive index). 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 more than one station on Flathead Reservation, we followed the methods developed by the BTO in their CES scheme (Peach et al. 1996) and inferred the statistical significance of overall changes in the indices of population size and productivity using confidence intervals derived from the standard errors of the mean percentage 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).

For each of the two stations operated for 13 years, 1993-2005, and for both of these stations combined, we calculated 13-year means for the numbers of adult and young birds captured per 600 net hours and for the reproductive index (number of young per adult) for each individual species and for all species pooled. Throughout this report, we use an alpha level of 0.05 for statistical significance, but we use the term "near-significant" or "nearly significant" to indicate differences for which $0.05 \leq P < 0.10$.

B. Analyses of trends in adult population size and productivity – We examined 13-year (1993-2005) trends in indices of adult population size and productivity for target species at the two long-running stations combined, and three-year (2003-2005) trends for all six stations combined. For trends in adult population size, we first calculated adult population indices for each species for each year based on an arbitrary starting indices of 1.0 in 1993 (13-year trends) and 2003 (three-year trends). 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 seven years (*PT*). Because the chain indices were based on percentage changes, we further calculated the average annual percent change (*APC*) over the ten-year period to estimate population trend for the species; *APC* (e.g. for the 13-year trend) was calculated as:

(actual 1993 value of *PSI* / predicted 1993 value of *PSI* based on the regression) * *PT*.

We present the *APC*, the standard error of the slope (*SE*), the correlation coefficient (*r),* and the significance of the correlation (*P*) to describe each trend. For 13-year trends, species for which r $\geq$ 0.3 are considered to have a substantially increasing trend; those for which $r \leq -0.3$ are considered to have a substantially decreasing trend; those for which absolute $r < 0.3$ and $SE \leq 0.021$ are considered to have a non-fluctuating and non-substantial trend; and those for which absolute $r < 0.3$ and $SE > 0.021$ are considered to have a widely fluctuating and non-substantial trend. For three-year trends, species for which r $\geq$ 0.7 are considered to have a substantially increasing trend; those for which $r \leq -0.7$ are considered to have a substantially decreasing trend; those for which absolute $r < 0.7$ and $SE \leq 0.389$ are considered to have a non-fluctuating and non-substantial trend; and those for which absolute $r < 0.7$ and $SE > 0.389$ are considered to have a widely fluctuating and non-substantial trend.

Trends in productivity, *PrT*, were calculated in an analogous manner by starting with actual productivity values in 1993 and 2003 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, for non-substantial trends, we do not attempt to distinguish between those that are highly fluctuating and those that are non-fluctuating.

C. Multivariate analyses on adult population size — For the three stations operated in 2002-2005 and the six stations operated in 2003-2005 we conducted multivariate ANOVAs on indices of adult population size (mean number of adult birds captured) as a function of year, station, and habitat type. We also used logistic regression to provide an analytical framework for examining productivity as a function of year, habitat type, and station while controlling for the other variables and effort. We performed these analyses on target species for which at least 10 adults were captured per year at all six stations combined (*cf.* Table 9). Habitat types were divided into unmanaged coniferous (Safe Harbor Marsh and Crow Creek), unmanaged cottonwood/willow (Woodpecker Haven and Spring Creek), and managed cottonwood/willow (Schall and Jocko River); station was not included in analyses examining effects of habitat type and vice versa. Analyses examining effects of year were very similar after adjusting for habitat type and station; results based on adjustment for habitat are presented.

Because the analyses are examining non-continuous explanatory variables, the 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. For both multivariate ANOVAs and logistic regressions we chose 2005 as the reference year, managed cottonwood/willow as the reference habitat, and Jocko River as the reference station. The relative number of adults for each reference category was set to zero. The ANOVAs also included a net-hour covariate to control for effort. 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 all other variables have been accounted for.

Data preparation for the ANOVA and Logistic Regression analyses was completed using data-management programs in dBASE5.7, and the analyses were completed using STATA (Stata Corporation 1995). Statistical significance for the multiple ANOVAs was determined based on the F-statistic and significance in logistic regression 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. Survivorship analyses – Modified Cormack-Jolly-Seber (CJS) mark-recapture analyses (Pollock et al.1990, Lebreton et al.1992) were conducted on the target species using 13 years (1993-2005) of capture histories of adult birds. Using the computer program TMSURVIV (White 1983, Hines et al. 2003), 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 a time-constant, between- and within-year transient model (Pradel et al. 1997, Nott and DeSante 2002, Hines et al. 2003). The use of the transient model ($\varphi p \tau$) 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.

The 13 years of data allowed us to consider all possible combinations of time-constant and time-dependent models for each of the three parameters estimated, for a total of eight models. We limited consideration to models that produced estimates for both survival and recapture probability that were neither 0 nor 1. Model goodness of fit was tested by using a Pearson's goodness-of-fit test. Of those models that fit the data, the one that produced the lowest Akaike Information Criterion, correcting for dispersion of data and for use with smaller sample sizes relative to the number of parameters examined ($QAIC_C$), was chosen as the optimal model (Burnham et al. 1995). Models showing $QAIC_C$'s within 2.0 $QAIC_C$ units of each other were considered effectively equivalent (Anderson and Burnham 1999). 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 over-dispersed data and small sample sizes.

To assess annual variation in survival for each species, we calculated $\Delta QAIC_C$ as the difference between the time-constant model ($\varphi p \tau$) and the best model with time-dependent survival but time-constant capture probability and proportion of residents ($\varphi_t p \tau$); thus, $\Delta QAIC_C$ was calculated as $QAIC_C(\varphi_t p \tau)$-$QAIC_C(\varphi p \tau)$, with lower (or more negative) $\Delta QAIC_C$ values indicating stronger inter-annual variation in survival.

RESULTS

We accumulated 2319.0 net-hours at the six MAPS stations on the Flathead Reservation in 2005; 2233.0 of these net-hours were comparable to 2004 data in a constant-effort manner (Table 1).

Indices of Adult Population Size and Post-fledging Productivity

A. 2005 values – The 2005 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 six stations on the Flathead Reservation in Table 2, and for all stations combined in Table 4. A total of 800 captures of 45 species was recorded during the summer of 2005. Newly banded birds comprised 69.6% of the total captures. The greatest number of total captures (180) was recorded at the Jocko River station and the smallest number of total captures (91) was recorded at the Crow Creek station. The highest species richness occurred at Safe Harbor Marsh (27 species) and the lowest species richness occurred at Crow Creek (14 species).

The capture rates (per 600 net-hours) of individual adult and young birds and the reproductive index during 2005 are presented for each species and for all species pooled at each of the six stations on the Flathead Reservation in Table 3, and for all stations combined in Table 4. 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 in 2005 was greatest at Spring Creek, followed in descending order by Jocko River, Safe Harbor Marsh, Schall, Woodpecker Haven, and Crow Creek.

The capture rate of young (Table 3) of all species pooled at each station in 2005 followed a somewhat different sequence to that of adults: Jocko River had the highest number followed by Woodpecker Haven, Spring Creek, Safe Harbor Marsh, Schall, and Crow Creek. The reproductive index at the stations in 2005 (Tables 3; the number of young per adult) was highest at Woodpecker Haven (0.39) followed by Jocko River (0.35), Safe Harbor Marsh (0.29), Schall (0.28), Spring Creek (0.23), and Crow Creek (0.19).

Among individual species, Black-capped Chickadee was the most frequently captured species in 2005, followed by Song Sparrow, Yellow Warbler, Gray Catbird, American Robin, "Traill's" Flycatcher, Lazuli Bunting, Chipping Sparrow, American Goldfinch, and American Redstart (Table 4). The most abundant breeding species, having a capture rate of at least 4.0 adults per 600 net-hours, in decreasing order, were Song Sparrow, Yellow Warbler, Gray Catbird, American Robin, "Traill's" Flycatcher, Black-capped Chickadee, Swainson's Thrush, American Goldfinch, Lazuli Bunting, Chipping Sparrow, and Cedar Waxwing (Table 4). 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 2005:

Woodpecker Haven
American Robin
Black-capped Chickadee
Red-naped Sapsucker
Black-headed Grosbeak
Northern Flicker
Yellow Warbler
Song Sparrow

Spring Creek
Song Sparrow
"Traill's" Flycatcher
Yellow Warbler
Black-capped Chickadee
Lazuli Bunting
Swainson's Thrush
Gray Catbird
Cedar Waxwing
American Goldfinch

Safe Harbor Marsh
Song Sparrow
Cedar Waxwing
"Traill's" Flycatcher
Chipping Sparrow
American Robin
Red-winged Blackbird
Dusky Flycatcher
Black-capped Chicadee
Common Yellowthroat

Jocko River
Gray Catbird
Yellow Warbler
Song Sparrow
Swainson's Thrush
American Redstart
Black-capped Chickadee
Red-eyed Vireo
"Traill's" Flycatcher
Lazuli Bunting

Schall
Yellow Warbler
American Goldfinch
"Traill's" Flycatcher
American Robin
Lazuli Bunting
Black-capped Chickadee
Gray Catbird
Song Sparrow
Western Wood-Pewee

Crow Creek
Lazuli Bunting
Gray Catbird
American Robin
Yellow Warbler
Chipping Sparrow
N.Rough-winged Swallow
Song Sparrow
House Wren

B. Comparisons between 2004 and 2005 – Adult population size for all species pooled for all stations combined decreased highly significantly, by -5.2% (Table 5). Thirty of 49 species showed decreases, a proportion near-significantly greater than 0.50. Decreases between 2004 and 2005 were recorded at five of the six stations, by amounts ranging from -19.8% at Woodpecker Haven to -36.6% at Crow Creek, whereas they increased by +11.8% at Safe Harbor Marsh. The proportion of decreasing species was significantly or near-significantly greater than 0.50 at Woodpecker Haven, Schall, and Crow Creek. Near-significant or significant decreases in the number of adults captured for all stations combined were recorded for eight species (Eastern Kingbird, Red-eyed Vireo, Swainson's Thrush, Gray Catbird, Cedar Waxwing, Nashville Warbler, Common Yellowthroat, and Lazuli Bunting) whereas no species showed such an increase.

Captures of young birds for all species pooled and for all stations combined also decreased highly significantly, by -46.0% between 2004 and 2005 (Table 6). Twenty-five of 30 species showed decreases, a proportion highly significantly greater than 0.50. Number of young captured for all species pooled decreased at five of six stations, by amounts ranging from -26.5% at Jocko River to -65.8% at Spring Creek, whereas it showed no change at Woodpecker Haven. The proportion of decreasing species significantly or near-significantly greater than 0.50 at Schall, Spring Creek, and Jocko River. Five species (Downy Woodpecker, Black-capped Chickadee, Gray Catbird, Yellow Warbler, and Bullock's Oriole) showed significant or near-significant decreases whereas no species showed such increases.

Reproductive index (number of young per adult) showed a non-significant decrease of -0.108 from 0.396 in 2004 to 0.288 in 2005 for all species pooled and all stations combined (Table 7). Decreases were recorded for 21 of 38 species, a proportion not significantly greater than 0.50. Decreases in productivity were observed three of the six stations, by amounts ranging from -0.240 at Safe Harbor Marsh and Jocko River to -0.305 at Spring Creek. Productivity increased at three stations by amounts ranging from +0.019 at Crow Creek to +0.076 at Woodpecker Haven. No station recorded a proportion of increasing (or decreasing) species that was significantly greater than 0.50. Three species (Red-eyed Vireo, Yellow Warbler, and Chipping Sparrow) showed significant or near-significant decreases across stations and one species (American Robin) showed such an increase.

Thus, in general, both population sizes and productivity decreased highly significantly between 2004 and 2005. This follows similar (but not quite as significant) decreases in these parameters between 2003 and 2004. These decreases were generally both species-wide and station-wide. Productivity also showed a non-significant decrease for the second consecutive year.

C. Thirteen-year and three-year mean population size and productivity values – Table 8 presents mean numbers of individual adults captured (an index of adult population size), mean numbers of individual young captured, and number of young per adult (reproductive index) during the 13-year period 1993-2005 for each of the two long-running stations and for both stations pooled. Table 9 presents the same data for the three-year period 2003-2005 at all six stations combined. Examination of all-species-pooled values in Table 8 indicates that adult population sizes, productivity (especially), and species richness were higher at Safe Harbor Marsh than at Crow Creek. We suspect that the presence of wetter habitats at Safe Harbor Marsh results in a higher diversity of both vegetation and birds than is found at the drier Crow Creek station.

The overall reproductive index of 0.30 during the 13-year period 1993-2005 at the two long-running stations (Table 8) is low compared to the mean value for all species pooled in the Northwest MAPS Region as a whole during the nine-year period 1993-2001 (0.57; calculated from MAPS data available at: http://www.birdpop.org/nbii/NBIIHome.asp). Of the 14 target species at Flathead used in survival analyses, 11 (Western Wood-Pewee, "Traill's" Flycatcher, House Wren, Swainson's Thrush, American Robin, Gray Catbird, Yellow Warbler, Spotted Towhee, Chipping Sparrow, Song Sparrow, and Lazuli Bunting) showed substantially ($\geq$ 20% with a mean of 51%) lower productivity at Flathead than in the Northwest Region; one species (Common Yellowthroat) showed slightly (< 10%) lower productivity at Flathead, one species (Black-capped Chickadee) showed slightly (< 10%) higher productivity at Flathead, and only one species, Brown-headed Cowbird, showed substantially (36%) higher productivity at Flathead than in the Northwestern Region as a whole. Although we are not comparing exactly the same span of years (1993-2005 vs. 1993-2001), we believe that these results suggest that landbird productivity is lower at Flathead than it should be, and that the reason may be high levels of nest-parasitism by Brown-headed Cowbirds.

Breeding populations in 2003-05 were highest at the Jocko River station, followed by Spring Creek, Schall, Crow Creek, Safe Harbor Marsh, and Woodpecker Haven (Table 9). Productivity during this three-year period showed a very different pattern, being highest at Schall, followed

by Safe Harbor Marsh, Jocko River, Woodpecker Haven, Spring Creek, and Crow Creek.

D. Thirteen-year and three-year trends in adult population size and productivity –Chain indices of adult population size for the 13 years, 1993-2005, for ten target species and for all species pooled at the two long-running stations (Safe Harbor Marsh and Crow Creek), are shown in Figure 1.

Five species showed positive 13-yr population trends while five showed negative trends (Fig. 1). Three species showed substantial declining population trends ($r \leq -0.3$), with those of "Traill's" Flycatcher being nearly significant, that of Common Yellowthroat being highly significant, and that of Song Sparrow being non-significant. Two species showed substantial increasing population trends ($r \geq 0.3$), with that of Yellow Warbler being nearly significant and that of Chipping Sparrow being significant. The remaining five species (Black-capped Chickadee, House Wren, American Robin, Gray Catbird, and Cedar Waxwing) fluctuated from year to year ($SE > 0.021$) with no substantial increases or decreases (absolute $r < 0.3$). Population trend for all species pooled was substantially and near-significantly negative, and indicated an annual decline of 1.5% per year.

Chain indices of adult population size for the 3 years, 2003-2005, for 26 target species and for all species pooled at all six stations, are shown in Figure 2. A remarkable 15 of these 26 species showed substantial declining trends ($r \leq 0.7$), 9 of which (for Downy Woodpecker, "Traill's" Flycatcher, Red-eyed Vireo, Swainson's Thrush, Cedar Waxwing, Common Yellowthroat, Spotted Towhee, Black-headed Grosbeak, and Brown-headed Cowbird) were significant or nearly so. By contrast only 3 species (American Redstart, Chipping Sparrow, and Red-winged Blackbird) showed substantial positive trends ($r \geq 0.7$), the one for Chipping Sparrow being nearly significant. Trends for the remaining 8 species were not substantially negative or positive (absolute $r \leq 0.7$); 5 of these (Red-naped Sapsucker, Northern Rough-winged Swallow, House Wren, American Robin, Song Sparrow, did not show wide fluctuation ($SE \leq 0.389$) whereas 3 of these (Dusky Flycatcher, Eastern Kingbird, Lazuli Bunting showed high fluctuation ($SE > 0.389$). Overall, 20 of the 26 species showed negative trends whereas only 6 showed positive trends. The trend for all species pooled was substantially negative ($r = 0.985$) and indicated a decline of 10.7% per year.

Chain indices of productivity index (number of young per adult) for each of the 13 years, 1993-2005, for the same ten target species and all species pooled at the two long-running stations are shown in Figure 3. Overall, productivity of six species declined and four increased. Productivity of five species declined substantially ($r \leq -0.3$); declines were highly significant for House Wren and Song Sparrow, significant for Black-capped Chickadee, and not significant for Gray Catbird and Chipping Sparrow. Two species showed substantially increasing trends in productivity ($r \geq 0.3$); these were nearly significant for Common Yellowthroat and not significant for Cedar Waxwing. Four species ("Traill's" Flycatcher, American Robin, Yellow Warbler, and Chipping Sparrow) showed non-substantial productivity trends (absolute $r < 0.3$). The productivity trend for all species pooled was not non-substantial and indicated a decline of 0.4% per year.

Chain indices of productivity for the 3 years, 2003-2005, for the same 26 target species and for all species pooled, at all six stations, are shown in Figure 2. Seven species (Red-naped Sapsucker, Northern Flicker, Dusky Flycatcher, House Wren, Yellow Warbler, Song Sparrow, and Black-headed Grosbeak) showed substantial declining trends ($r \leq 0.7$), one of which (for Yellow Warbler) was nearly significant. By contrast only one species (Swainson's Thrush) showed a substantial positive trends ($r \geq 0.7$), which was not significant. The remaining 18 species sowed no substantial trend (absolute $r \leq 0.7$). Overall, 18 of the 26 species showed negative trends whereas only 1 showed a positive trend, with the remaining 7 showing no trend. The trend for all species pooled was substantially ($r = 1.000$) and highly significantly ($P = 0.004$) negative, indicating a decline of 9.3% per year.

E. Multivariate analyses of adult population size and productivity.–Multivariate analyses assessing variation in numbers of adults captured by year, habitat, and station, for the four-year period 2002-2005, were performed for all species pooled (Fig. 5) and for 6 target species with >10 adults captured per year at Flathead (Figs. 6-11). Controlling for effort (net hours) and habitat type, significantly fewer adults (of all species pooled) were captured in 2005 than in 2003 and near-significantly fewer adults were captured in 2004 than in 2005 (Fig. 5**A**). Most of the 6 individual species showed similar patterns, although no significant differences were noted (Figs. 6**A**-11**A**). See also Figure 2.

Controlling for effort and year, significantly fewer adults (all species pooled) were captured in unmanaged coniferous forests than in managed cottonwood-willow habitats, and a similar number of adults were captured in unmanaged than in managed cottonwood-willow habitats (Fig. 5**B**). Similar differences were observed for Black-capped Chickadee (Fig. 7**B**) and Yellow Warbler (Fig. 10**B**), wheras a similar pattern (without the significant difference) was observed for "Traill's" Flycatcher (Fig. 6**B**), American Robin (Fig. 8**B**), and Song Sparrow (Fig. 11**B**). For Gray Catbird, the number of adults captured in both unmanaged habitat types were near-significantly lower than those captured in the managed cottonwood-willow habitat.

Controlling for effort and year, more adults (all species pooled) were captured at Jocko River than at all other stations, with the numbers of adults at Woodpecker Haven, Safe Harbor Marsh, Schall, and Crow Creek being significantly lower (Fig. 5**C**). It is possible that there was an elevational component to breeding bird abundance, with the most birds caught at the elevation of Jocko River and decreasing numbers recorded with both decreasing and increasing elevation. Somewhat similar patterns (but with different significance values) were recorded for "Traill's" Flycatcher (Fig. 6**C**), Black-capped Chickadee (Fig. 7**C**), Gray Catbird (Fig. 9**C**), Yellow Warbler (Fig. 10**C**), and Song Sparrow (Fig. 11**C**). Only American Robin showed a different pattern with respect to elevation and station, with numbers of adults captured generally declining with increasing elevation, and being significantly higher at both Woodpecker Haven and Schall than at Jocko River (Fig. 8**C**).

Controlling for habitat type, productivity (of all species pooled) was significantly higher in 2003 and 2004 than in 2005, with the value for 2002 being similar to that of 2005 (Fig. 5**D**). Productivity of "Traill's" Flycatcher could not be compared across parameters because no young birds were captured at Flathead in 2002-2005. We believe that this is because the nesting season

is later for this species than all others at Flathead, most young not fledging until after the first week of August, when the MAPS season ends. The other five species showed various patterns of productivity according to year, with those of Yellow Warbler (Fig. 10**D**) and Song Sparrow (Fig. 11**D**) being similar to that of all species pooled. See also Figure 4.

Controlling for year, productivity of all species pooled was significantly lower in both unmanaged coniferous forests and in unmanaged cottonwood-willow habitats than in managed cottonwood-willow habitats (Fig. 5**E**). A similar pattern (but with different significance levels) were observed for American Robin (Fig. 8**E**), Gray Catbird (Fig. 9**E**), Yellow Warbler (Fig. 10**E**), and Song Sparrow (Fig. 11**E**). This suggests that the management efforts may be successful in enhancing reproduction for these species, some of which are riparian specialists. Black-capped Chickadee showed a different pattern, productivity being non-significantly highest in coniferous habitats.

Controlling for year, productivity of all species pooled was highest at the mid-elevation Schall station (Fig. 5**F**); as with adults captured, productivity decreased with both decreasing and increasing elevation within Flathead. Somewhat similar patterns were recorded for Black-capped Chickadee (Fig. 7**F**), Gray Catbird (Fig. 9**F**), Yellow Warbler (Fig. 10**F**), and Song Sparrow (Fig. 11**F**). As with adults captured, only American Robin showed a different pattern with respect to elevation and station, with productivity being significantly higher at Jocko River than at most other stations (Fig. 8**F**).

Estimates of Adult Survivorship

Using all 13 years of data (1993-2005) from the two long-running stations (Safe Harbor Marsh and Crow Creek), estimates of adult survival and recapture probabilities and proportion of residents were obtained for 14 target species breeding on the Flathead Reservation (Tables 10-11). Because of the existence of floaters, failed breeders, and dispersing adults, transient models, which account for the proportion of residents in the population, produce less biased estimates of adult survivorship than do non-transient models, provided there are sufficient data (four years or more) to estimate the proportion of residents. Thus, we only present the results of transient models.

The time-constant transient model ($\varphi p \tau$) was selected over all time-dependent transient models ($QAIC_C$ was at least 2.0 $QAIC_C$ units lower than the $QAIC_C$ of any other model) for all 14 species (Table 10). Survival has remained fairly constant over the past 13 years among the species at Flathead. Slight time-dependence was indicated for Black-capped Chickadee ($\Delta QAIC_C = 4.10$) for Black-capped Chickadee and Yellow Warbler ($\Delta QAIC_C = 5.51$), but not enough for the time-dependent model to be considered equivalent to the time-independent model ($\Delta QAIC_C \leq 2.0$). For the remaining 12 species, $\Delta QAIC_C$ ranged from 10.36 for Lazuli Bunting to 37.99 for Spotted Towhee, indicating effectively no time-dependence in survival.

Survivorship estimates for the 14 species (Table 11), using time-constant models, ranged from 0.274 for Chipping Sparrow to 0.679 for American Robin, with a mean of 0.495. Recapture probability ranged from 0.088 for Spotted Towhee to 0.687 for Song Sparrow, with a mean of 0.360. Proportion of residents varied from 0.131 for "Traill's" Flycatcher to 1.000 for four

species (Table 11), with a mean of 0.658. Precision of survival rates continues to improve, even after 13 years of data collection (mean CV of 30.6 for the 14 species in 2004 compared to 31.2 for the same set of species in 2003).

Adult survival at Flathead Reservation in 1993-2005 was comparable to that of the Northwestern MAPS region as a whole in 1992-2001 (see http://www.birdpop.org/nbii/surv/default.asp). The mean of 0.495 at Flathead compares to a mean of 0.497 for the same 14 species in the Northwestern Region as a whole. Survival at Flathead was higher than that of the Northwest Region for nine of the 14 species, with three species (Black-capped Chickadee, House Wren, and Common Yellowthroat) showing substantially (>10%) higher values at Flathead than in the Northwest Region. The remaining five species had lower values at Flathead than in the Northwest Region as a whole, with four of the five species ("Traill's" Flycatcher, Gray Catbird, Chipping Sparrow, and Lazuli Bunting) showing substantially lower survival at Flathead.

DISCUSSION AND CONCLUSIONS

Constant-effort comparisons indicated that both population sizes and productivity of breeding landbirds decreased significantly at Flathead Reservation between 2004 and 2005. These decreases were generally both species-wide and station-wide. This comes on the heels of decreases in both parameters between 2003 and 2004 (*cf*. Figs. 2 & 4), an unusual observation among MAPS data. More typically, both breeding population size and productivity alternate between high and low years (often asynchronously), reflecting density-dependent population dynamics. These decreases for the second straight year suggest anomalous weather patterns and, indeed, the season was extremely dry except for a major rainstorm during the first few days of June, which flooded the MAPS stations. It was thought by the MAPS interns that the severity of the rainstorm, at the height of the nesting season, probably affected reproductive success in the region negatively. Given the density dependent effects that are commonly observed and assuming typical weather in 2006 we might expect to see very low breeding populations (because of the lack of recruitment of one-year-old birds) but much higher productivity (due to lack of competition) during the 2006 season.

The 13-year (1993-2005) reproductive index for all species pooled at the two long-running stations (Safe Harbor Marsh and Crow Creek), 0.30, is very low compared with this value in the Northwest MAPS Region as a whole during the nine-year period 1993-2001 (0.57). Furthermore, of 14 target species, 11 showed substantially ($\geq$ 20%) lower productivity at Flathead than in the Northwest Region, only two showed similar (< 10% different) productivity at Flathead, and the only species showing substantially higher (36%) productivity at Flathead was Brown-headed Cowbird. These results suggest that landbird productivity is lower at Flathead than it should be, and that the reason may be high levels of nest-parasitism by Brown-headed Cowbirds. Several species with substantially lower productivity at Flathead than in the Northwest Region, including "Traill's" Flycatcher (61% lower at Flathead), Yellow Warbler (62% lower), Song Sparrow (45% lower), and Lazuli Bunting (93% lower), are known to be frequent hosts to cowbird parasitism. It is possible that landbirds at Flathead have not yet adapted to the relatively recent (past 100 years) invasion of the area by Brown-headed Cowbirds from the Prairie Region. It is also possible that the abundance of livestock-related agriculture in the region may be helping to support high populations of cowbirds, which increases nest-parasitism pressure on local landbirds.

A primary objective of MAPS is to evaluate the success of on-going management actions such as habitat restoration and fire-ecology management. On the Flathead Reservation, four new stations were established in 2002 and 2003 in areas subject to on-going and proposed habitat restoration efforts in the Jocko River watershed. At the Schall station, an old homestead was replanted with native grassland species in spring 2003 and at the Jocko River station, revegetation efforts commenced in fall 2003 with the planting of seedling willows and cottonwoods. These efforts are aimed at re-channeling the river to it's original banks and restoring the adjoining cottonwood/willow riparian habitat (which has been reduced during the past 100 years by grazing and development to small patches) to a continuos strip.

Between 2004 and 2005, breeding populations of all species pooled at both Jocko River and Schall decreased by -33.8% and -26.1%, respectively, representing larger decreases than recorded at all six stations combined (-25.8%). The decrease in reproductive index at Jocko River
(-0.035) was lower but the decrease in reproductive index at Schall (-0.305) was greater than that recorded at all six stations combined (-0.108). These data suggest that the habitat restoration efforts at these two stations, which commenced in 2003, may not yet be affecting breeding landbirds. Revegetated areas at these two stations still consist of developing seedlings and newer grasslands that appear not yet to have matured to the point of assisting bird populations. On the other hand, multivariate analyses suggests that adult population size and (especially) productivity are higher at the managed stations than at the unmanaged stations when effects of year and effort are controlled. This is very promising news concerning management efforts along the Jocko River, and we hope that, as the restoration efforts reach maturity, that these favorable results will strengthen.

Thirteen-year (1993-2005) analyses of breeding populations at Flathead indicate a substantial and nearly significant decline of -1.5% per year for all species pooled at the two long-running stations combined. This may not seem severe at first, but over the 13-year period it equates to a substantial decline of about 18% in breeding population sizes. Populations of three species ("Traill's" Flycatcher, Common Yellowthroat, and Song Sparrow) showed substantially declining populations whereas those of four species (Yellow Warbler, Gray Catbird, Cedar Waxwing, and Chipping Sparrow) showed substantial increasing populations. Thirteen-year analyses of reproductive index at the two stations also indicate a slight and non-significant long-term decline in productivity, of 0.7% per year (nearly 9% over 13 years) for all species pooled. Four species (Black-capped Chickadee, House Wren, Gray Catbird, and Song Sparrow) showed substantially declining productivity trends whereas two species (Cedar Waxwing and Common Yellowthroat) showed substantially increasing productivity trends.

We were able to obtain survivorship estimates for 14 target species on Flathead Reservation, using data from just the two long-running stations. $\Delta QAIC_c$ values indicated little or no inter-annual variation in survival over the 13-year period for any species. Mean CV(φ) for these 14 species after the 2005 season was 20.6, compared with 31.2 following the 2004 season, indicating continued improvement of the precision of our survival estimates, even after 13 years of data have been collected. This indicates that maximum precision may not be obtained until more than 13 years of data are available (see Rosenberg 1996, Rosenberg et al.1999).

Adult survival at Flathead Reservation in 1993-2005 is comparable to that of the Northwestern MAPS region as a whole in 1992-2001. The mean estimated survival value of 0.495 for the 14 species at Flathead compares to a mean of 0.497 for the same 14 species in the Northwestern Region as a whole. Survival at Flathead was substantially higher than that of the Northwest Region for three species (Black-capped Chickadee, House Wren, and Common Yellowthroat) and it was substantially lower at Flathead for four species ("Traill's" Flycatcher, Gray Catbird, Chipping Sparrow, and Lazuli Bunting).

A primary goal of the MAPS program is to determine the proximate causes (productivity or survival) accounting for declining landbird population sizes. One method of doing this is to compare mean vital rates for all species pooled to similar data collected during the MAPS program throughout the Northwest Region for the years 1992-2001 and available at the IBP website at http://www.birdpop.org/nbii/NBIIHome.asp.

Two of the three species with substantial declines at Flathead, "Traill's" Flycatcher and Song Sparrow, showed substantially lower productivity at Flathead than in the Northwest overall. Adult survival for "Traill's" Flycatcher was also substantially lower at Flathead than in the Northwest, whereas survival of Song Sparrows was slightly higher. This indicates that low productivity may be driving or contributing substantially to the population declines of these two species at Flathead. Both species are commonly subjected to Brown-headed Cowbird nest parasitism, further suggesting that parasitism may be a problem for landbirds at Flathead. Interestingly, it appears as though low productivity may be driving the generally negative population trends on six Region-6 National Forests (in Washington and Oregon), as well. This suggests that productivity problems leading to population declines may be occurring on Flathead Reservation and thus may be correctable through habitat restoration or other proactive management strategies. Increasing riparian patch sizes at Flathead, as currently being undertaken, will increase nest cover and decrease edge habitat, which in turn should help reduce parasitism by cowbirds. The third declining species, Common Yellowthroat, showed slightly better values for both productivity and survival, indicating that some other cause, such as juvenile survival away from Flathead and/or recruitment into the population, may be low.

We have recently initiated two broad-scale analyses to help us further understand the population dynamics of landbirds and formulate potential management actions to assist bird populations. First, modeling spatial variation in vital rates as a function of spatial variation in population trends can further help us to determine the proximate demographic causes of population trends within a species at multiple spatial scales (DeSante et al. 2001). Second, we have found that patterns of landscape structure detected within a two- to four-kilometer radius area around each MAPS 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). These types of analyses provide extremely powerful tools to identify and formulate management actions aimed at reversing declining populations and maintaining stable or increasing populations of landbirds, because they can address the particular vital rate responsible for the decline. By coupling station-specific and landscape-level information on habitat characteristics with spatially explicit weather data and estimates and indices of population trends and vital rates of target species in a GIS-based framework, we will be able to control for large-scale weather and climate effects (Nott et al. 2002) and identify the landscape-level habitat characteristics associated with both low and high productivity and low and high survival rates for each target species.

Using such results, we will then be able to identify generalized management guidelines, and formulate specific management actions, to reverse the population declines of target landbird species on Reservations and elsewhere (Nott et al. 2003a, 2005). These management strategies will involve efforts to modify the habitat from characteristics associated with low productivity to characteristics associated with high productivity (for species for which low productivity is

driving the population decline).

The data collected at the MAPS stations at Flathead Reservation during their first 13 years have revealed that the population dynamics of the breeding birds are complex, as apparently are the causes for population changes and, for those deemed problematic, their likely solutions. This complexity, in turn, underscores the importance of standardized, long-term data. In general, the analyses of MAPS data indicate that bird populations at Flathead and in the Pacific Northwest are declining, and that these declines appear to be caused more by deficiencies in productivity on the breeding grounds than by low survival on the winter grounds.

We understand that continued efforts at habitat restoration and monitoring the effects of such restoration at Flathead Reservation must be curtailed in 2006 due to lack of funding. Nevertheless, we hope some day to be able to revisit the Reservation and use habitat modeling to assess the effects of habitat restoration both at the local scale (as correlated with planned vegetation structure modeling associated with restoration efforts) and at the landscape level (as related to the sizes of continuous patches that occur along the Jocko River). We also hope that such techniques may be useful in assessing responses of bird populations to restoration activities on other Indian Reservations in western North America.

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Table 1. Summary of the 2005 MAPS program on the Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Station					Avg	2005 operation		
Name	Code	No.	Major Habitat Type	Latitude-longitude	Elev. (m)	Total number of net-hours[1]	No. of periods	Inclusive dates
Woodpecker Haven	WOHA	11234	cottonwood-willow riparian	47°10'19"N,-114°04'60"W	920	392.3 (382.0)	7	6/04 - 8/01
Safe Harbor Marsh	SHMA	11199	Freshwater marsh, mixed conifer forest, low shrubs	47°46'27"N,-114°08'50"W	881	383.3 (363.2)	7	5/30 - 7/30
Schall	SCHA	11232	cottonwood-willow riparian	47°12'57"N,-114°08'29"W	870	396.7 (383.3)	7	6/09 - 8/03
Spring Creek	SPCK	11233	cottonwood-willow riparian	47°14’03"N,-114°09’48"W	853	383.3 (361.8)	7	6/08 - 8/02
Jocko River	JORI	11221	cottonwood-willow riparian, surrounded by grassland	47°16’54"N,-114°11’60"W	825	372.3 (357.3)	7	5/31 - 7/31
Crow Creek	CWCR	11198	Riparian, ponderosa pine woodland, grassy meadow	47°28'16"N,-114°16'43"W	786	391.0 (385.3)	7	6/10 - 8/04
ALL STATIONS COMBINED						2319.0(2233.0)	7	5/30 - 8/04

Table 2. Capture summary for the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2005. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Red-naped Sapsucker	6		6						1	3								
Downy Woodpecker	1			1			1		2	2		2						
Hairy Woodpecker				1														
Northern Flicker	4		2															
Western Wood-Pewee				1			4			2								
"Traill's" Flycatcher				7		1	8			15		5	4			3		
Hammond's Flycatcher				1														
Dusky Flycatcher	1			3		1												
Eastern Kingbird							1		1									
Cassin's Vireo				1									1					
Warbling Vireo	1			3		1	1						1					
Red-eyed Vireo	1												4		5			
Northern Rough-winged Swallow																5		
Black-capped Chickadee	20		16	8		3	15		12	16		8	15		10	6		2
Mountain Chickadee				3														
Red-breasted Nuthatch				1												1		
House Wren																6		
Marsh Wren				4														
Veery													1					
Swainson's Thrush	1			2			2			6			9		3			
American Robin	18		5	7		2	8		1	2			3			8		2
Gray Catbird	3						6		4	3		9	18		13	8		3
Cedar Waxwing				10						5			1					
Orange-crowned Warbler	5			4		1				3								
Nashville Warbler				3														

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2005. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Yellow Warbler	5		1	2		1	13		6	11		13	15		13	4		9
American Redstart							1			2			4		11			
Northern Waterthrush							1			1			1		1			
MacGillivray's Warbler	2																	
Common Yellowthroat				2		2												
Wilson's Warbler				1												1		
Yellow-breasted Chat										1			1					
Western Tanager				1									1					
Spotted Towhee				1									3					
Chipping Sparrow	1			7		1							2			6		5
Song Sparrow	6		1	14		10	8		4	28		10	22	1	6	5		1
Dark-eyed Junco				1									1					
Black-headed Grosbeak	5		3									1	3					
Lazuli Bunting	1						7		4	7		1	4			8		5
Red-winged Blackbird				5														
Brewer's Blackbird							1											
Brown-headed Cowbird				1			1		2			3	1		2	1		
Bullock's Oriole	2									1								
American Goldfinch							8		4	4		1				2		
House Sparrow							2											
ALL SPECIES POOLED	83	0	34	95	0	23	88	0	41	112	0	53	115	1	64	64	0	27
Total Number of Captures		117			118			129			165			180			91	
Number of Species	18	0	7	27	0	10	18	0	11	18	0	10	22	1	9	14	0	7
Total Number of Species		18			27			19			20			22			14	

Table 3. Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2005.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek		
Species	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index
Red-naped Sapsucker	9.2	0.0	0.00				1.5	0.0	0.00	3.1	1.6	0.50						
Downy Woodpecker	1.5	0.0	0.00	0.0	1.6	und.[1]	3.0	0.0	0.00	4.7	0.0	0.00						
Hairy Woodpecker				1.6	0.0	0.00												
Northern Flicker	7.6	0.0	0.00															
Western Wood-Pewee				1.6	0.0	0.00	6.1	0.0	0.00	3.1	0.0	0.00						
"Traill's" Flycatcher				12.5	0.0	0.00	12.1	0.0	0.00	26.6	0.0	0.00	6.4	0.0	0.00	4.6	0.0	0.00
Hammond's Flycatcher				1.6	0.0	0.00												
Dusky Flycatcher	1.5	0.0	0.00	6.3	0.0	0.00												
Eastern Kingbird							1.5	0.0	0.00									
Cassin's Vireo				1.6	0.0	0.00							1.6	0.0	0.00			
Warbling Vireo	1.5	0.0	0.00	4.7	0.0	0.00	1.5	0.0	0.00				1.6	0.0	0.00			
Red-eyed Vireo	1.5	0.0	0.00										9.7	0.0	0.00			
N. Rough-winged Swallow																7.7	0.0	0.00
Black-capped Chickadee	16.8	22.9	1.36	6.3	9.4	1.50	9.1	21.2	2.33	12.5	18.8	1.50	11.3	17.7	1.57	4.6	7.7	1.67
Mountain Chickadee				0.0	4.7	und.												
Red-breasted Nuthatch				0.0	1.6	und.										0.0	1.5	und.[1]
House Wren																6.1	3.1	0.50
Marsh Wren				1.6	4.7	3.00												
Veery													1.6	0.0	0.00			
Swainson's Thrush	1.5	0.0	0.00	3.1	0.0	0.00	3.0	0.0	0.00	9.4	0.0	0.00	12.9	4.8	0.38			
American Robin	24.5	7.6	0.31	11.0	1.6	0.14	10.6	3.0	0.29	3.1	0.0	0.00	3.2	1.6	0.50	12.3	1.5	0.13
Gray Catbird	4.6	0.0	0.00				9.1	1.5	0.17	7.8	1.6	0.20	30.6	6.4	0.21	13.8	1.5	0.11
Cedar Waxwing				15.7	0.0	0.00				7.8	0.0	0.00	1.6	0.0	0.00			

Table 3. (cont.) Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2005.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek		
Species	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index
Orange-crowned Warbler	0.0	4.6	und.[1]	3.1	3.1	1.00				4.7	0.0	0.00						
Nashville Warbler				3.1	1.6	0.50												
Yellow Warbler	7.6	0.0	0.00	3.1	0.0	0.00	21.2	3.0	0.14	20.3	4.7	0.23	30.6	3.2	0.11	10.7	1.5	0.14
American Redstart							1.5	0.0	0.00	3.1	0.0	0.00	12.9	0.0	0.00			
Northern Waterthrush							1.5	0.0	0.00	1.6	0.0	0.00	1.6	0.0	0.00			
MacGillivray's Warbler	3.1	0.0	0.00															
Common Yellowthroat				6.3	0.0	0.00												
Wilson's Warbler				1.6	0.0	0.00										1.5	0.0	0.00
Yellow-breasted Chat										1.6	0.0	0.00	1.6	0.0	0.00			
Western Tanager				1.6	0.0	0.00							0.0	1.6	und.			
Spotted Towhee				0.0	1.6	und.							3.2	1.6	0.50			
Chipping Sparrow	1.5	0.0	0.00	12.5	0.0	0.00							3.2	0.0	0.00	9.2	0.0	0.00
Song Sparrow	6.1	3.1	0.50	20.3	7.8	0.39	9.1	4.5	0.50	36.0	12.5	0.35	17.7	20.9	1.18	7.7	1.5	0.20
Dark-eyed Junco				1.6	0.0	0.00							1.6	0.0	0.00			
Black-headed Grosbeak	9.2	0.0	0.00							1.6	0.0	0.00	4.8	0.0	0.00			
Lazuli Bunting	1.5	0.0	0.00				10.6	1.5	0.14	11.0	0.0	0.00	6.4	0.0	0.00	15.3	0.0	0.00
Red-winged Blackbird				7.8	0.0	0.00												
Brewer's Blackbird							1.5	0.0	0.00									
Brown-headed Cowbird				1.6	0.0	0.00	3.0	0.0	0.00	3.1	0.0	0.00	3.2	0.0	0.00	1.5	0.0	0.00
Bullock's Oriole	1.5	1.5	1.00							1.6	0.0	0.00						
American Goldfinch							16.6	0.0	0.00	7.8	0.0	0.00				3.1	0.0	0.00
House Sparrow							3.0	0.0	0.00									

Table 3. (cont.) Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2005.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek		
Species	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index
ALL SPECIES POOLED	100.9	39.8	0.39	129.9	37.6	0.29	125.5	34.8	0.28	170.6	39.1	0.23	167.6	58.0	0.35	98.2	18.4	0.19
Number of Species	17	5		23	10		19	6		20	5		21	8		13	7	
Total Number of Species		18			27			19			20			22			14	

[1] Reproductive index (young/adult) is undefined because no adults of this species were captured at this station in this year.

Table 4. Summary of results for all six Flathead Reservation of the Confederated Salish and Kootenai Tribes MAPS stations combined in 2005.

Species	Birds captured			Birds/600 nethours		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Red-naped Sapsucker	9		7	2.3	0.3	0.11
Downy Woodpecker	5		4	1.6	0.3	0.17
Hairy Woodpecker	1			0.3	0.0	0.00
Northern Flicker	4		2	1.3	0.0	0.00
Western Wood-Pewee	7			1.8	0.0	0.00
"Traill's" Flycatcher	37		6	10.3	0.0	0.00
Hammond's Flycatcher	1			0.3	0.0	0.00
Dusky Flycatcher	4		1	1.3	0.0	0.00
Eastern Kingbird	1		1	0.3	0.0	0.00
Cassin's Vireo	2			0.5	0.0	0.00
Warbling Vireo	6		1	1.6	0.0	0.00
Red-eyed Vireo	5		5	1.8	0.0	0.00
N. Rough-winged Swallow	5			1.3	0.0	0.00
Black-capped Chickadee	80		51	10.1	16.3	1.62
Mountain Chickadee	3			0.0	0.8	und.[1]
Red-breasted Nuthatch	2			0.0	0.5	und.
House Wren	6			1.0	0.5	0.50
Marsh Wren	4			0.3	0.8	3.00
Veery	1			0.3	0.0	0.00
Swainson's Thrush	20		3	4.9	0.8	0.16
American Robin	46		10	10.6	2.6	0.24
Gray Catbird	38		29	10.9	1.8	0.17
Cedar Waxwing	16			4.1	0.0	0.00
Orange-crowned Warbler	12		1	1.3	1.3	1.00
Nashville Warbler	3			0.5	0.3	0.50
Yellow Warbler	50		43	15.5	2.1	0.13
American Redstart	7		11	2.8	0.0	0.00
Northern Waterthrush	3		1	0.8	0.0	0.00
MacGillivray's Warbler	2			0.5	0.0	0.00
Common Yellowthroat	2		2	1.0	0.0	0.00
Wilson's Warbler	2			0.5	0.0	0.00
Yellow-breasted Chat	2			0.5	0.0	0.00
Western Tanager	2			0.3	0.3	1.00
Spotted Towhee	4			0.5	0.5	1.00
Chipping Sparrow	16		6	4.4	0.0	0.00
Song Sparrow	83	1	32	16.0	8.3	0.52

Table 4. (cont.) Summary of results for all six Flathead Reservation of the Confederated Salish and Kootenai Tribes MAPS stations combined in 2005.

	Birds captured			Birds/600 nethours		
Species	Newly banded	Un-banded	Recap-tured	Adults	Young	Reprod. Index
Dark-eyed Junco	2			0.5	0.0	0.00
Black-headed Grosbeak	8		4	2.6	0.0	0.00
Lazuli Bunting	27		10	7.5	0.3	0.03
Red-winged Blackbird	5			1.3	0.0	0.00
Brewer's Blackbird	1			0.3	0.0	0.00
Brown-headed Cowbird	4		7	2.1	0.0	0.00
Bullock's Oriole	3			0.5	0.3	0.50
American Goldfinch	14		5	4.7	0.0	0.00
House Sparrow	2			0.5	0.0	0.00
ALL SPECIES POOLED	557	1	242	131.4	37.8	0.29
Total Number of Captures		800				
Number of Species	45	1	23	43	18	
Total Number of Species		45			45	

[1] Reproductive index (young/adult) is undefined because no adults of this species were captured at this location in this year.

Table 5. Percentage changes between 2004 and 2005 in the numbers of individual ADULT birds captured at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	n[1]	All six stations combined: Number of adults 2004	Number of adults 2005	Percent change	SE[2]	
Lewis's Woodpecker	-100.0						1	2	0	-100.0		
Red-naped Sapsucker	-25.0		-80.0	0.0			3	15	9	-40.0	20.1	
Downy Woodpecker	-50.0		-33.3	200.0	-100.0	-100.0	5	9	6	-33.3	34.6	
Hairy Woodpecker		++++[3]					1	0	1	++++[3]		
Northern Flicker	150.0			-100.0			2	3	5	66.7	111.1	
Western Wood-Pewee	-100.0	0.0	33.3	++++[3]	-100.0	-100.0	6	12	7	-41.7	38.8	
Traill's Flycatcher	-100.0	166.7	-42.9	-11.1	300.0	-40.0	6	45	39	-13.3	20.4	
Hammond's Flycatcher		++++	-100.0				2	1	1	0.0	200.0	
Dusky Flycatcher	++++[3]	300.0	-100.0		-100.0	-100.0	5	5	5	0.0	89.4	
Western Flycatcher				-100.0		-100.0	2	3	0	-100.0	88.9	
Eastern Kingbird			0.0	-100.0		-100.0	3	6	1	-83.3	22.0	*
Cassin's Vireo		-50.0		-100.0	++++[3]		3	6	2	-66.7	34.7	
Warbling Vireo	++++	++++	-50.0	-100.0	++++	-100.0	6	9	6	-33.3	59.6	
Red-eyed Vireo	0.0			-100.0	-25.0	-100.0	4	11	7	-36.4	14.0	*
N. Rough-winged Swallow			-100.0			150.0	2	3	5	66.7	111.1	
Black-capped Chickadee	57.1	-20.0	-14.3	-50.0	-57.1	-25.0	6	53	38	-28.3	16.7	
Mountain Chickadee							0	0	0			
Red-breasted Nuthatch	-100.0						1	1	0	-100.0		
House Wren	-100.0	-100.0				33.3	3	5	4	-20.0	48.0	
Marsh Wren		++++					1	0	1	++++		
Veery					++++		1	0	1	++++		
Swainson's Thrush	++++	0.0	0.0	-14.3	-42.9	-100.0	6	28	19	-32.1	12.2	**
American Robin	25.0	-22.2	0.0	++++	100.0	100.0	6	33	41	24.2	19.4	
Gray Catbird	50.0	-100.0	0.0	-72.2	-57.8	-52.6	6	91	42	-53.8	6.5	***
European Starling			-100.0				1	1	0	-100.0		
Cedar Waxwing	-100.0	-36.4		25.0	-75.0	-100.0	5	26	13	-50.0	19.0	*
Orange-crowned Warbler		0.0		++++		-100.0	3	3	5	66.7	150.3	

Table 5. (cont.) Percentage changes between 2004 and 2005 in the numbers of individual ADULT birds captured at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	n[1]	All six stations combined: Number of adults 2004	Number of adults 2005	Percent change	SE[2]	
Nashville Warbler	-100.0	++++		-100.0	-100.0		4	11	1	-90.9	13.2	***
Yellow Warbler	-28.6	++++	0.0	-45.8	-5.3	-30.0	6	74	59	-20.3	11.4	
Yellow-rumped Warbler		-100.0					1	1	0	-100.0		
American Redstart	-100.0		++++[3]	0.0	33.3		4	9	11	22.2	22.7	
Northern Waterthrush			-50.0	++++	++++		3	2	3	50.0	150.0	
MacGillivray's Warbler	++++	-100.0	-100.0	-100.0			4	6	2	-66.7	45.4	
Common Yellowthroat		100.0	-100.0	-100.0		-100.0	4	11	2	-81.8	22.3	**
Wilson's Warbler		++++		-100.0		++++[3]	3	1	2	100.0	300.0	
Yellow-breasted Chat			-100.0	0.0	++++		3	2	2	0.0	86.6	
Western Tanager		++++	-100.0	-100.0			3	2	1	-50.0	75.0	
Spotted Towhee		-100.0			0.0	-100.0	3	6	2	-66.7	34.7	
Chipping Sparrow	-50.0	33.3			100.0	100.0	4	12	17	41.7	25.5	
Song Sparrow	33.3	62.5	-14.3	91.7	0.0	0.0	6	46	62	34.8	21.4	
Dark-eyed Junco		-66.7			0.0		2	4	2	-50.0	25.0	
Black-headed Grosbeak	500.0	-100.0		-75.0	0.0		4	9	10	11.1	78.2	
Lazuli Bunting	-90.0		-45.5	-53.3	0.0	-28.6	5	54	28	-48.1	11.2	**
Red-winged Blackbird		33.3	-100.0				2	4	4	0.0		
Brewer's Blackbird			++++				1	0	1	++++		
Brown-headed Cowbird	-100.0	0.0	0.0	-33.3	0.0	0.0	6	11	8	-27.3	16.9	
Bullock's Oriole	0.0		-100.0	0.0	-100.0		4	4	2	-50.0	28.9	
Pine Siskin		-100.0			-100.0	-100.0	3	5	0	-100.0	88.9	
American Goldfinch	-100.0		-8.3	25.0	-100.0	++++	5	25	18	-28.0	27.3	
House Sparrow			++++				1	0	2	++++		
ALL SPECIES POOLED	-19.8	11.8	-26.1	-30.3	-33.8	-36.6	6	670	497	-25.8	5.2	***

Table 5. (cont.) Percentage changes between 2004 and 2005 in the numbers of individual ADULT birds captured at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	All six stations combined
No. species that increased[4]	10(4)	14(8)	4(3)	8(4)	9(5)	6(2)	15(5)
No. species that decreased[5]	15(10)	12(7)	19(10)	19(11)	13(7)	18(13)	30(6)
No. species remained same	2	4	6	4	6	2	4
Total Number of Species	27	30	29	31	28	26	49
Proportion of increasing (decreasing) species	(0.556)	0.467	(0.655)	(0.613)	(0.464)	(0.692)	(0.613)
Sig. of increase (decrease)[6]	(0.351)	0.708	(0.068)	(0.141)	(0.714)	(0.038)	(0.076)
	**		*			**	*

[1] Number of stations lying within the breeding range of the species at which at least one individual adult bird of the species was captured in either year.
[2] Standard error of the percent change in the number of individual adults captured.
[3] Increase indeterminate (infinite) because no adult was captured during 2004.
[4] No. of species for which adults were captured in 2005 but not in 2004 are in parentheses.
[5] No. of species for which adults were captured in 2004 but not in 2005 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.
*** $P < 0.01$; ** $0.01 < P < 0.05$; * $0.05 < P < 0.10$.

Table 6. Percentage changes between 2004 and 2005 in the numbers of individual YOUNG birds captured at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	n[1]	All six stations combined: Number of young 2004	All six stations combined: Number of young 2005	All six stations combined: Percent change	All six stations combined: SE[2]	
Lewis's Woodpecker							0	0	0			
Red-naped Sapsucker			-100.0	0.0			2	2	1	-50.0	50.0	
Downy Woodpecker		++++[1]	-100.0	-100.0	-100.0		4	5	1	-80.0	26.9	*
Hairy Woodpecker							0	0	0			
Northern Flicker				-100.0			1	1	0	-100.0		
Western Wood-Pewee	-100.0						1	1	0	-100.0		
Traill's Flycatcher							0	0	0			
Hammond's Flycatcher			-100.0				1	1	0	-100.0		
Dusky Flycatcher							0	0	0			
Western Flycatcher							0	0	0			
Eastern Kingbird							0	0	0			
Cassin's Vireo							0	0	0			
Warbling Vireo							0	0	0			
Red-eyed Vireo					-100.0		1	1	0	-100.0		
N. Rough-winged Swallow							0	0	0			
Black-capped Chickadee	0.0	-14.3	-22.2	-45.5	-26.7	-37.5	6	85	63	-25.9	7.7	**
Mountain Chickadee		200.0					1	1	3	200.0		
Red-breasted Nuthatch		++++			-100.0	++++[1]	3	1	2	100.0	300.0	
House Wren			-100.0			0.0	2	3	2	-33.3	44.4	
Marsh Wren		-25.0					1	4	3	-25.0		
Veery							0	0	0			
Swainson's Thrush				-100.0	50.0		2	3	3	0.0	66.7	
American Robin	++++[1]	++++	++++[1]		++++[1]	++++	5	0	10	++++[1]		
Gray Catbird			++++	-75.0	-42.9	0.0	4	12	7	-41.7	16.6	*
European Starling							0	0	0			
Cedar Waxwing		-100.0					1	3	0	-100.0		
Orange-crowned Warbler	200.0	++++	-100.0	-100.0	-100.0		5	6	4	-33.3	60.2	

Table 6. (cont.) Percentage changes between 2004 and 2005 in the numbers of individual YOUNG birds captured at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	n[1]	All six stations combined: Number of young 2004	All six stations combined: Number of young 2005	All six stations combined: Percent change	All six stations combined: SE[2]	
Nashville Warbler	-100.0	-100.0		-100.0	-100.0	-100.0	5	14	0	-100.0	88.9	
Yellow Warbler	-100.0	-100.0	-86.7	-66.7	-66.7	-50.0	6	37	8	-78.4	6.1	***
Yellow-rumped Warbler							0	0	0			
American Redstart				-100.0			1	1	0	-100.0		
Northern Waterthrush							0	0	0			
MacGillivray's Warbler							0	0	0			
Common Yellowthroat		-100.0					1	3	0	-100.0		
Wilson's Warbler							0	0	0			
Yellow-breasted Chat							0	0	0			
Western Tanager					++++		1	0	1	++++		
Spotted Towhee		0.0			-85.7		2	8	2	-75.0	18.8	
Chipping Sparrow	-100.0	-100.0				-100.0	3	4	0	-100.0	88.9	
Song Sparrow	-50.0	-28.6	-80.0	-38.5	160.0	-50.0	6	44	31	-29.5	30.4	
Dark-eyed Junco		-100.0					1	2	0	-100.0		
Black-headed Grosbeak							0	0	0			
Lazuli Bunting			++++	-100.0			2	5	1	-80.0	40.0	
Red-winged Blackbird		-100.0					1	2	0	-100.0		
Brewer's Blackbird							0	0	0			
Brown-headed Cowbird		-100.0	-100.0				2	4	0	-100.0	88.9	
Bullock's Oriole	++++		-100.0	-100.0	-100.0		4	11	1	-90.9	13.2	***
Pine Siskin		-100.0					1	1	0	-100.0		
American Goldfinch							0	0	0			
House Sparrow							0	0	0			
ALL SPECIES POOLED	0.0	-38.9	-64.6	-65.8	-26.5	-29.4	6	265	143	-46.0	10.1	***

Table 6. (cont.) Percentage changes between 2004 and 2005 in the numbers of individual YOUNG birds captured at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	All six stations combined
No. species that increased[4]	3(2)	5(4)	3(3)	0(0)	4(2)	2(2)	4(2)
No. species that decreased[5]	5(4)	12(9)	10(7)	12(8)	10(6)	5(2)	25(13)
No. species remained same	1	1	0	1	0	2	1
Total Number of Species	9	18	13	13	14	9	30
Proportion of increasing (decreasing) species	0.333	(0.667)	(0.769)	(0.923)	(0.714)	(0.556)	(0.833)
Sig. of increase (decrease)[6]	0.910	(0.119)	(0.046) **	(0.002) ***	(0.090) *	(0.500)	(0.000) ***

[1] Number of stations lying within the breeding range of the species at which at least one individual young bird of the species was captured in either year.
[2] Standard error of the percent change in the number of individual young captured.
[3] Increase indeterminate (infinite) because no young bird was captured during 2004.
[4] No. of species for which young birds were captured in 2005 but not in 2004 are in parentheses.
[5] No. of species for which young birds were captured in 2004 but not in 2005 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.
*** $P < 0.01$; ** $0.01 < P < 0.05$; * $0.05 < P < 0.10$.

Table 7. Changes between 2004 and 2005 in the REPRODUCTIVE INDEX (young/adult) at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	n[1]	All six stations combined: Reproductive Index 2004	2005	Change	SE[2]	
Lewis's Woodpecker	+-+-+[3]						1	0.000	und.[4]	+-+-+[3]		
Red-naped Sapsucker	0.000		-0.200	0.000			3	0.133	0.111	-0.022	0.178	
Downy Woodpecker	0.000	+-+-+[3]	-0.667	-2.000	+-+-+[3]	+-+-+[3]	6	0.556	0.167	-0.389	0.319	
Hairy Woodpecker		+-+-+					1	und.[4]	0.000	+-+-+		
Northern Flicker	0.000			+-+-+[3]			2	0.333	0.000	-0.333	0.444	
Western Wood-Pewee	+-+-+	0.000	0.000	+-+-+	+-+-+	+-+-+	6	0.083	0.000	-0.083	0.079	
Traill's Flycatcher	+-+-+	0.000	0.000	0.000	0.000	0.000	6	0.000	0.000	0.000	0.000	
Hammond's Flycatcher		+-+-+	+-+-+[3]				2	1.000	0.000	-1.000	0.000	
Dusky Flycatcher	+-+-+	0.000	+-+-+		+-+-+	+-+-+	5	0.000	0.000	0.000	0.000	
Western Flycatcher				+-+-+		+-+-+	2	0.000	und.	+-+-+		
Eastern Kingbird			0.000	+-+-+		+-+-+	3	0.000	0.000	0.000	0.000	
Cassin's Vireo		0.000		+-+-+	+-+-+		3	0.000	0.000	0.000	0.000	
Warbling Vireo	+-+-+	+-+-+	0.000	+-+-+	+-+-+	+-+-+	6	0.000	0.000	0.000	0.000	
Red-eyed Vireo	0.000			+-+-+	-0.125	+-+-+	4	0.091	0.000	-0.091	0.033	*
N. Rough-winged Swallow			+-+-+			0.000	2	0.000	0.000	0.000	0.000	
Black-capped Chickadee	-0.779	0.100	-0.238	0.125	0.762	-0.333	6	1.604	1.658	0.054	0.286	
Mountain Chickadee		+-+-+					1	und.	und.	+-+-+		
Red-breasted Nuthatch	+-+-+	+-+-+			+-+-+	+-+-+	4	1.000	und.	+-+-+		
House Wren	+-+-+	+-+-+	+-+-+			-0.167	4	0.600	0.500	-0.100	0.306	
Marsh Wren		+-+-+					1	und.	3.000	+-+-+		
Veery					+-+-+		1	und.	0.000	+-+-+		
Swainson's Thrush	+-+-+	0.000	0.000	-0.143	0.232	+-+-+	6	0.107	0.158	0.051	0.121	
American Robin	0.333	0.143	0.286	+-+-+	0.500	0.125	6	0.000	0.244	0.244	0.052	***
Gray Catbird	0.000	+-+-+	0.167	-0.022	0.055	0.059	6	0.132	0.167	0.035	0.043	
European Starling			+-+-+				1	0.000	und.	+-+-+		
Cedar Waxwing	+-+-+	-0.273		0.000	0.000	+-+-+	5	0.115	0.000	-0.115	0.084	
Orange-crowned Warbler	+-+-+	0.500	+-+-+	+-+-+	+-+-+	+-+-+	6	2.000	0.800	-1.200	2.174	

Table 7. (cont.) Changes between 2004 and 2005 in the REPRODUCTIVE INDEX (young/adult) at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	n[1]	All six stations combined: Reproductive Index 2004	2005	Change	SE[2]	
Nashville Warbler	+-+-+	+-+-+		+-+-+	+-+-+	+-+-+	5	1.273	0.000	-1.273	1.211	
Yellow Warbler	-0.571	+-+-+	-0.929	-0.144	-0.205	-0.057	6	0.500	0.136	-0.364	0.147	*
Yellow-rumped Warbler		+-+-+					1	0.000	und.	+-+-+		
American Redstart	+-+-+		+-+-+	-0.500	0.000		4	0.111	0.000	-0.111	0.132	
Northern Waterthrush			0.000	+-+-+	+-+-+		3	0.000	0.000	0.000	0.000	
MacGillivray's Warbler	+-+-+	+-+-+	+-+-+	+-+-+			4	0.000	0.000	0.000	0.000	
Common Yellowthroat		-3.000	+-+-+	+-+-+		+-+-+	4	0.273	0.000	-0.273	0.334	
Wilson's Warbler		+-+-+		+-+-+		+-+-+	3	0.000	0.000	0.000	0.000	
Yellow-breasted Chat			+-+-+	0.000	+-+-+		3	0.000	0.000	0.000	0.000	
Western Tanager		+-+-+	+-+-+	+-+-+	+-+-+		4	0.000	1.000	1.000	1.633	
Spotted Towhee		+-+-+			-3.000	+-+-+	3	1.333	1.000	-0.333	1.408	
Chipping Sparrow	-0.500	-0.333			0.000	-0.333	4	0.333	0.000	-0.333	0.045	***
Song Sparrow	-0.417	-0.490	-1.643	-0.735	0.727	-0.200	6	0.957	0.500	-0.457	0.293	
Dark-eyed Junco		-0.667			0.000		2	0.500	0.000	-0.500	0.250	
Black-headed Grosbeak	0.000	+-+-+		0.000	0.000		4	0.000	0.000	0.000	0.000	
Lazuli Bunting	0.000		0.167	-0.333	0.000	0.000	5	0.093	0.036	-0.057	0.092	
Red-winged Blackbird		-0.667	+-+-+				2	0.500	0.000	-0.500	0.250	
Brewer's Blackbird			+-+-+				1	und.	0.000	+-+-+		
Brown-headed Cowbird	+-+-+	-1.000	-1.500	0.000	0.000	0.000	6	0.364	0.000	-0.364	0.281	
Bullock's Oriole	1.000		+-+-+	-2.000	+-+-+		4	2.750	0.500	-2.250	1.843	
Pine Siskin		+-+-+			+-+-+	+-+-+	3	0.200	und.	+-+-+		
American Goldfinch	+-+-+		0.000	0.000	+-+-+	+-+-+	5	0.000	0.000	0.000	0.000	
House Sparrow			+-+-+				1	und.	0.000	+-+-+		
ALL SPECIES POOLED	0.076	-0.240	-0.305	-0.240	0.035	0.019	6	0.396	0.288	-0.108	0.067	

Table 7. (cont.) Changes between 2004 and 2005 in the REPRODUCTIVE INDEX (young/adult) at six constant-effort MAPS stations on Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Species	Woodp. Haven	Safe Har. Marsh	Schall	Spring Creek	Jocko River	Crow Creek	All six stations combined
No. species that increased	2	3	3	1	5	2	5
No. species that decreased	4	7	6	8	3	5	21
No. species remained same	7	5	7	7	8	4	12
Total Number of Species[5]	13	15	16	16	16	11	38
Proportion of increasing (decreasing) species	0.154	(0.467)	(0.375)	(0.500)	0.313	0.182	(0.553)
Sig. of increase (decrease)[6]	0.998	(0.696)	(0.895)	(0.598)	0.962	0.994	(0.314)

[1] Number of stations lying within the breeding range of the species at which at least one individual aged bird of the species was captured in either year.
[2] Standard error of the change in the reproductive index.
[3] The change in reproductive index is undefined at this station because no adult individual of the species was captured in one of the two years.
[4] Reproductive index not given because no adult individual of the species was captured in the year shown.
[5] Species for which the change in the reproductive index 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 reproductive index at the two individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the 13 years, 1993-2005. Data for each species are included only from stations that lie within the breeding range of the species.

	Safe Harbor Marsh			Crow Creek			All stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
American Kestrel				0.1	0.0	0.00	0.1	0.0	0.00
Red-naped Sapsucker	0.1	0.0	0.00				0.1	0.0	0.00
Downy Woodpecker	0.5	0.1	0.00	1.0	0.1	0.13	0.8	0.1	0.04
Hairy Woodpecker	0.2	0.0	0.00	0.0	0.1	und.[2]	0.1	0.1	0.00
Northern Flicker	0.1	0.0	0.00	0.3	0.1	0.00	0.2	0.1	0.00
Western Wood-Pewee	1.3	0.2	0.13	2.9	0.1	0.02	2.1	0.1	0.06
"Traill's" Flycatcher	6.3	0.2	0.08	7.6	0.3	0.04	7.0	0.2	0.03
Least Flycatcher	0.3	0.0	0.00				0.1	0.0	0.00
Hammond's Flycatcher	1.4	0.0	0.00	0.6	0.0	0.00	1.0	0.0	0.00
Dusky Flycatcher	3.4	0.5	0.08	0.7	0.0	0.00	2.1	0.2	0.06
"Western" Flycatcher	0.4	0.0	0.00	1.3	0.3	0.25	0.8	0.1	0.25
Western Kingbird				0.1	0.0	0.00	0.1	0.0	0.00
Eastern Kingbird	0.1	0.0	0.00	0.9	0.0	0.00	0.5	0.0	0.00
Cassin's Vireo	1.0	0.0	0.00	0.3	0.1	0.00	0.7	0.1	0.08
Warbling Vireo	2.9	0.0	0.00	0.8	0.0	0.00	1.9	0.0	0.00
Red-eyed Vireo				0.3	0.0	0.00	0.1	0.0	0.00
Tree Swallow	0.1	0.0	0.00				0.1	0.0	0.00
Violet-green Swallow	0.5	0.0	0.00				0.2	0.0	0.00
N. Rough-winged Swallow				2.4	0.3	0.22	1.2	0.2	0.22
Bank Swallow				0.6	0.0	0.00	0.3	0.0	0.00
Black-capped Chickadee	6.6	13.9	2.77	15.3	12.2	1.04	10.9	13.0	1.37
Mountain Chickadee	0.6	1.8	1.50				0.3	0.9	1.50
Red-breasted Nuthatch	2.7	1.2	0.36	1.5	0.9	0.56	2.1	1.1	0.59
Pygmy Nuthatch	0.6	0.6	1.00				0.3	0.3	1.00
Brown Creeper	0.0	0.1	und.[2]				0.0	0.1	und.[2]
House Wren	0.2	0.2	0.00	10.1	4.0	0.45	5.2	2.1	0.47
Marsh Wren	1.0	4.3	3.08				0.5	2.2	3.08
Golden-crowned Kinglet	0.1	0.2	0.00	0.0	0.2	und.	0.1	0.2	0.00
Townsend's Solitaire	0.1	0.1	0.00				0.1	0.1	0.00
Swainson's Thrush	5.5	0.8	0.17	2.8	0.3	0.03	4.2	0.6	0.13
American Robin	10.2	1.0	0.13	6.2	0.8	0.12	8.2	0.9	0.14
Gray Catbird	1.3	0.0	0.00	15.8	1.1	0.08	8.6	0.6	0.07
Cedar Waxwing	24.8	0.5	0.03	3.9	0.4	0.15	14.4	0.4	0.04
Tennessee Warbler	0.1	0.0	0.00				0.1	0.0	0.00
Orange-crowned Warbler	1.5	0.7	0.25	0.8	0.3	0.00	1.1	0.5	0.19
Nashville Warbler	0.4	0.2	0.25	0.0	0.3	und.	0.2	0.2	0.25
Yellow Warbler	1.3	0.1	0.00	13.6	2.6	0.18	7.4	1.4	0.17
Yellow-rumped Warbler	0.3	0.1	0.00	0.0	0.2	und.	0.1	0.2	0.00
Townsend's Warbler	0.0	0.1	und.	0.3	0.0	0.00	0.2	0.1	0.50
Northern Waterthrush	0.0	0.1	und.	0.2	0.0	0.00	0.1	0.1	0.00
MacGillivray's Warbler	1.9	0.3	0.05	0.8	0.0	0.00	1.4	0.2	0.13
Common Yellowthroat	13.4	5.1	0.59	1.5	0.2	0.06	7.6	2.7	0.36
Wilson's Warbler	0.2	0.0	0.00	0.6	0.0	0.00	0.4	0.0	0.00
Western Tanager	2.9	0.3	0.08				1.5	0.2	0.08

Table 8. (cont.) Mean numbers of aged individual birds captured per 600 net-hours and reproductive index at the two individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the 13 years, 1993-2005. Data for each species are included only from stations that lie within the breeding range of the species.

	Safe Harbor Marsh			Crow Creek			All stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
Spotted Towhee	2.0	1.6	0.25	2.0	0.7	0.39	2.0	1.1	0.58
Chipping Sparrow	4.4	0.6	0.12	3.8	0.6	0.25	4.1	0.6	0.18
Vesper Sparrow	0.3	0.0	0.00	0.1	0.0	0.00	0.2	0.0	0.00
Song Sparrow	10.7	6.7	0.79	7.8	3.2	0.57	9.2	4.9	0.63
Dark-eyed Junco	2.4	2.4	1.17	0.0	0.2	und.	1.2	1.3	1.27
Black-headed Grosbeak	0.6	0.0	0.00	0.7	0.0	0.00	0.6	0.0	0.00
Lazuli Bunting				9.5	0.2	0.02	4.7	0.1	0.02
Red-winged Blackbird	2.5	0.4	0.17				1.3	0.2	0.17
Yellow-headed Blackbird	0.2	0.0	0.00				0.1	0.0	0.00
Brown-headed Cowbird	3.5	0.4	0.09	1.4	0.2	0.14	2.4	0.3	0.19
Bullock's Oriole				1.1	0.6	0.25	0.5	0.3	0.25
Cassin's Finch	1.1	0.0	0.00				0.5	0.0	0.00
House Finch	0.1	0.2	2.00				0.1	0.1	2.00
Red Crossbill	0.5	0.4	0.50				0.3	0.2	0.50
Pine Siskin	6.6	0.6	0.21	0.4	0.0	0.00	3.5	0.3	0.20
American Goldfinch				0.9	0.0	0.00	0.4	0.0	0.00
Evening Grosbeak	0.4	0.0	0.00				0.2	0.0	0.00
ALL SPECIES POOLED	129.9	46.2	0.37	121.0	30.4	0.24	125.6	38.3	0.30
Number of Species	50	34		39	28		60	42	
Total Number of Species		53			44			61	

[1] Years for which the reproductive index was undefined (no adult birds were captured in the year) are not included in the mean reproductive index.

[2] The reproductive index is undefined at this station because no young individual of the species was ever captured in the same year as an adult individual of the species.

Table 9. Mean numbers of aged individual birds captured per 600 net-hours and reproductive index at the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the three years, 2003-2005. Only data from stations where the species was a regular or usual breeder and summer resident during the years the station was operated over the years 1992-2001 were included.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek			All stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
Lewis's Woodpecker	1.0	0.0	0.00																0.2	0.0	0.00
Red-naped Sapsucker	8.5	0.0	0.00	0.5	0.0	0.00	5.4	2.0	0.27	3.1	1.5	0.50	0.5	0.0	0.00				3.0	0.6	0.19
Downy Woodpecker	3.0	0.0	0.00	1.0	0.5	0.00	4.9	2.0	0.36	3.1	1.5	0.83	2.5	1.0	0.42	1.0	0.5	0.50	2.6	0.9	0.33
Hairy Woodpecker				1.0	0.0	0.00				0.5	0.0	0.00							0.3	0.0	0.00
Northern Flicker	6.5	0.5	0.06				0.5	0.5	1.00	2.1	1.0	0.67	1.5	1.5	1.00				1.8	0.6	0.26
Western Wood-Pewee	4.4	0.5	0.17	1.5	0.0	0.00	11.8	0.0	0.00	1.6	0.0	0.00	1.5	0.0	0.00	3.4	0.0	0.00	4.1	0.1	0.03
"Traill's" Flycatcher	3.4	0.0	0.00	9.6	0.0	0.00	13.9	0.0	0.00	32.9	0.0	0.00	7.1	0.0	0.00	7.3	0.0	0.00	12.3	0.0	0.00
Least Flycatcher	1.0	0.0	0.00	0.5	0.0	0.00	1.0	1.0	1.00	0.5	0.0	0.00	0.5	0.0	0.00				0.6	0.2	0.17
Hammond's Flycatcher				0.5	0.0	0.00	0.5	0.5	1.00										0.2	0.1	0.50
Dusky Flycatcher	0.5	0.0	0.00	5.1	0.5	0.07	1.0	0.0	0.00				0.5	0.0	0.00	1.4	0.0	0.00	1.4	0.1	0.05
"Western" Flycatcher										1.0	0.0	0.00				2.9	0.5	0.13	0.7	0.1	0.10
Eastern Kingbird	0.5	0.0	0.00				1.5	0.0	0.00	2.0	0.0	0.00				0.5	0.0	0.00	0.7	0.0	0.00
Cassin's Vireo				2.0	0.0	0.00				3.0	0.0	0.00	0.5	0.0	0.00				0.9	0.0	0.00
Warbling Vireo	2.0	0.0	0.00	1.6	0.0	0.00	2.5	0.0	0.00	2.0	0.0	0.00	0.5	0.0	0.00	2.4	0.0	0.00	1.8	0.0	0.00
Red-eyed Vireo	2.0	0.0	0.00							1.0	0.0	0.00	12.7	0.5	0.04	0.5	0.0	0.00	2.7	0.1	0.03
Tree Swallow							0.5	0.0	0.00										0.1	0.0	0.00
N. Rough-winged Swal.							0.5	0.0	0.00							5.0	0.0	0.00	0.9	0.0	0.00
Black-capped Chickadee	14.0	21.9	1.65	7.0	16.0	2.23	10.9	20.3	1.97	20.0	30.8	1.54	17.7	25.3	1.50	6.4	9.3	1.49	12.6	20.5	1.63
Mountain Chickadee				0.5	3.5	3.00													0.1	0.6	3.00
Red-breasted Nuthatch	0.5	0.0	0.00	0.5	0.5	0.00							0.0	0.5	und.[2]	0.0	1.5	und.[2]	0.2	0.4	1.50
Pygmy Nuthatch				0.5	2.0	4.00													0.1	0.3	4.00
Brown Creeper				0.0	0.5	und.[2]													0.0	0.1	und.[2]
House Wren	0.5	0.0	0.00	0.5	0.5	0.00	0.0	0.5	und.[2]	0.0	0.5	und.[2]	0.0	0.5	und.	6.4	3.9	0.61	1.3	1.0	0.76
Marsh Wren				0.5	3.6	3.00													0.1	0.6	3.00
Golden-crowned Kinglet				0.5	0.0	0.00	0.0	0.5	und.										0.1	0.1	1.00
Veery													1.0	0.0	0.00				0.2	0.0	0.00
Swainson's Thrush	0.5	0.0	0.00	3.0	0.5	0.17	2.5	0.0	0.00	9.2	1.0	0.11	20.7	3.6	0.21	2.4	0.0	0.00	6.3	0.8	0.13
American Robin	28.9	6.5	0.20	10.6	0.5	0.05	19.7	3.5	0.16	2.6	0.5	0.17	5.5	3.5	0.57	10.4	1.5	0.14	13.0	2.7	0.18
Gray Catbird	5.0	0.0	0.00	2.0	0.0	0.00	9.4	1.5	0.16	23.0	3.5	0.16	64.8	16.1	0.23	26.4	1.5	0.07	21.7	3.7	0.17
European Starling							0.5	0.0	0.00										0.1	0.0	0.00

Table 9. (cont.) Mean numbers of aged individual birds captured per 600 net-hours and reproductive index at the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the three years, 2003-2005. Only data from stations where the species was a regular or usual breeder and summer resident during the years the station was operated over the years 1992-2001 were included.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek			All stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
Cedar Waxwing	2.0	0.0	0.00	19.1	1.5	0.08	2.9	0.0	0.00	9.3	0.0	0.00	6.0	1.0	0.10	2.9	0.0	0.00	7.0	0.4	0.05
Orange-crowned Warbler	0.0	2.0	und.[2]	2.0	1.5	0.75	0.0	2.0	und.	2.1	1.5	0.00	1.0	1.0	0.00	0.5	0.5	0.00	0.9	1.4	1.67
Nashville Warbler	0.5	0.5	1.00	1.0	1.0	0.50	0.0	0.5	und.	1.0	5.0	5.00	5.5	1.0	0.55	0.0	0.5	und.	1.3	1.4	1.19
Yellow Warbler	9.9	3.4	0.32	2.0	0.5	0.00	20.3	35.3	1.82	34.9	10.7	0.30	32.5	10.5	0.31	14.2	4.9	0.31	18.9	10.9	0.53
Yellow-rumped Warbler				0.5	0.0	0.00													0.1	0.0	0.00
Townsend's Warbler							0.0	0.5	und.										0.0	0.1	und.
American Redstart	0.5	0.0	0.00				0.5	0.0	0.00	4.6	0.5	0.17	7.8	0.0	0.00				2.2	0.1	0.03
Northern Waterthrush							2.0	0.0	0.00	0.5	0.0	0.00	0.5	0.5	0.00				0.5	0.1	0.00
MacGillivray's Warbler	1.0	0.0	0.00	1.0	0.0	0.00	2.0	1.0	1.00	2.0	1.0	0.50	1.5	1.0	0.67	0.5	0.0	0.00	1.3	0.5	0.26
Common Yellowthroat				4.1	2.5	1.22	1.0	0.0	0.00	4.6	0.0	0.00	0.0	0.5	und.	2.9	0.0	0.00	2.1	0.5	0.19
Wilson's Warbler				0.5	0.0	0.00				0.5	0.0	0.00				1.0	0.0	0.00	0.3	0.0	0.00
Yellow-breasted Chat							0.5	0.0	0.00	2.1	0.0	0.00	2.0	0.0	0.00				0.8	0.0	0.00
Western Tanager				1.5	0.0	0.00	0.5	0.5	0.00	0.5	0.0	0.00	0.5	1.5	2.00				0.5	0.3	0.67
Spotted Towhee				4.5	1.5	0.25				0.0	0.5	und.	4.5	9.0	1.78	1.9	0.0	0.00	1.8	1.8	1.02
Chipping Sparrow	1.5	0.5	0.25	7.2	1.0	0.17							1.6	0.0	0.00	5.5	0.5	0.08	2.6	0.3	0.10
Song Sparrow	6.0	3.5	0.59	12.3	8.1	0.86	11.4	17.2	1.46	28.9	17.4	0.70	18.8	19.9	1.06	9.3	3.4	0.37	14.3	11.5	0.82
Lincoln's Sparrow	0.0	0.5	und.																0.0	0.1	und.
Dark-eyed Junco				3.0	1.0	0.22							1.0	0.0	0.00				0.7	0.2	0.17
Black-headed Grosbeak	4.0	0.0	0.00	2.0	0.0	0.00	0.0	0.5	und.	2.5	0.0	0.00	10.5	1.5	0.08				3.2	0.3	0.09
Lazuli Bunting	5.9	0.0	0.00				11.9	1.5	0.18	14.8	2.5	0.10	4.6	0.0	0.00	16.2	0.0	0.00	8.9	0.7	0.07
Red-winged Blackbird				5.6	1.0	0.22	1.0	0.0	0.00										1.1	0.2	0.17
Western Meadowlark	0.5	0.0	0.00																0.1	0.0	0.00
Brewer's Blackbird							1.5	0.0	0.00										0.3	0.0	0.00
Brown-headed Cowbird	1.0	0.5	0.00	4.0	0.5	0.33	5.9	1.5	0.50	6.7	0.0	0.00	3.1	0.5	0.17	1.9	0.0	0.00	3.7	0.5	0.12
Bullock's Oriole	1.0	0.5	0.50				1.0	5.4	5.50	1.0	1.0	1.00	0.5	0.5	1.00	0.5	0.0	0.00	0.7	1.2	1.50
House Finch				0.5	1.0	2.00	0.5	1.0	2.00										0.2	0.3	2.00
Red Crossbill				0.5	0.0	0.00													0.1	0.0	0.00
Pine Siskin	0.0	0.5	und.	2.5	1.0	0.63							1.0	0.0	0.00	0.5	0.0	0.00	0.7	0.2	1.07
American Goldfinch	2.9	0.0	0.00				19.8	0.0	0.00	6.1	0.0	0.00	4.0	0.0	0.00	1.5	0.0	0.00	5.8	0.0	0.00
House Sparrow							1.0	0.0	0.00										0.2	0.0	0.00

Table 9. (cont.) Mean numbers of aged individual birds captured per 600 net-hours and reproductive index at the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the three years, 2003-2005. Only data from stations where the species was a regular or usual breeder and summer resident during the years the station was operated over the years 1992-2001 were included.

	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek			All stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
ALL SPECIES POOLED	118.8	41.3	0.35	122.7	50.7	0.42	170.5	99.0	0.54	229.8	80.6	0.34	244.5	100.8	0.40	135.6	28.4	0.21	169.8	66.6	0.38
Number of Species	30	13		39	24		34	22		33	17		34	22		28	12		57	42	
Total Number of Species		33			40			40			35			37			30			60	

[1] Years for which the reproductive index was undefined (no adult birds were captured in the year) are not included in the mean reproductive index.
[2] The reproductive index is undefined at this station because no young individual of the species was ever captured in the same year as an adult individual of the species.

Table 10. Summary statistics for survival analyses with temporally variable survival and recapture probabilities and proportion of residents in transient models using 13 years (1993-2005) of mark-recapture data from two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. $QAIC_C$[1] and (GOF)[2] are presented for all models.

	Transient Models								
Species	$\varphi p \tau$ [3]	$\varphi_t p \tau$ [4]	$\varphi p_t \tau$ [5]	$\varphi p \tau_t$ [6]	$\varphi_t p_t \tau$ [7]	$\varphi_t p \tau_t$ [8]	$\varphi p_t \tau_t$ [9]	$\varphi_t p_t \tau_t$ [10]	$\Delta QAIC_C$
Western Wood-Pewee	40.31* (1.000)	71.13 (1.000)	73.02 (1.000)	79.80 (1.000)	211.00 (1.000)	253.70 (1.000)	254.40 (1.000)	undf.	30.82
"Traill's" Flycatcher	40.45* (1.000)	57.54 (1.000)	61.30 (1.000)	60.65 (1.000)	87.31 (1.000)	87.55 (1.000)	90.72 (1.000)	123.50 (1.000)	17.09
Black-capped Chickadee	121.40* (1.000)	125.50 (1.000)	130.50 (1.000)	133.40 (1.000)	137.50 (1.000)	148.50 (1.000)	149.60 (1.000)	160.70 (1.000)	4.10
House Wren	36.85* (1.000)	53.06 (1.000)	50.53 (1.000)	68.80 (1.000)	84.66 (1.000)	93.47 (1.000)	91.12 (1.000)	139.90 (1.000)	16.21
Swainson's Thrush	46.54* (1.000)	68.83 (1.000)	70.90 (1.000)	75.79 (1.000)	153.50 (1.000)	170.00 (1.000)	169.40 (1.000)	678.10 (1.000)	22.29
American Robin	71.64* (1.000)	86.04 (1.000)	86.65 (1.000)	85.75 (1.000)	106.30 (1.000)	108.60 (1.000)	107.10 (1.000)	132.50 (1.000)	14.40
Gray Catbird	74.57* (1.000)	88.86 (1.000)	84.04 (1.000)	87.03 (1.000)	101.20 (1.000)	109.10 (1.000)	106.00 (1.000)	130.20 (1.000)	14.29
Yellow Warbler	95.79* (1.000)	101.30 (1.000)	106.90 (1.000)	110.10 (1.000)	125.60 (1.000)	127.40 (1.000)	129.20 (1.000)	157.90 (1.000)	5.51
Common Yellowthroat	101.20* (1.000)	121.00 (1.000)	120.30 (1.000)	119.00 (1.000)	146.80 (1.000)	148.00 (1.000)	145.90 (1.000)	181.20 (1.000)	19.80
Spotted Towhee	20.39* (1.000)	58.38 (1.000)	58.75 (1.000)	62.09 (1.000)	203.80 (1.000)	242.40 (1.000)	241.30 (1.000)	undf.	37.99

Table 10. (cont.) Summary statistics for survival analyses with temporally variable survival and recapture probabilities and proportion of residents in transient models using 13 years (1993-2005) of mark-recapture data from two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. $QAIC_C$[1] and (GOF)[2] are presented for all models.

	Transient Models								
Species	$\varphi p\tau$ [3]	$\varphi_t p\tau$ [4]	$\varphi p_t\tau$ [5]	$\varphi p\tau_t$ [6]	$\varphi_t p_t\tau$ [7]	$\varphi_t p\tau_t$ [8]	$\varphi p_t\tau_t$ [9]	$\varphi_t p_t\tau_t$ [10]	$\Delta QAIC_C$
Chipping Sparrow	34.80*	55.84	56.42	59.68	108.10	116.90	115.20	236.60	21.04
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Song Sparrow	80.90*	99.07	95.89	99.81	115.50	123.40	120.30	144.80	18.17
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Lazuli Bunting	68.99*	79.35	85.56	83.35	114.90	116.60	119.60	175.30	10.36
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Brown-headed Cowbird	37.64*	66.73	68.93	72.86	184.00	212.00	212.70	undf.	29.09
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)		

1 Akaike Information Criterion ($QAIC_C$) given as -2(log-likelihood) + 2(number of estimable parameters) with corrections for small sample sizes and overdispersion of data.

[2] Goodness-of-fit is a measure of how well the actual distribution of data fits the theoretical distribution calculated using the estimates provided by the model. The larger the value provided by the GOF test the better the model describes the data.

[3] $\varphi p\tau$ Model: Transient model with temporally-constant survival probability, recapture probability, and proportion of residents (invariable from year to year).

[4] $\varphi_t p\tau$ Model: Transient model with temporally-variable survival probability; and temporally-constant recapture probability and proportion of residents.

[5] $\varphi p_t\tau$ Model: Transient model with temporally-variable recapture probability; and temporally-constant survival probability and prop of residents.

[6] $\varphi p\tau_t$ Model: Transient model with temporally-variable proportion of residents; and temporally-constant survival and recapture probabilities.

[7] $\varphi_t p_t\tau$ Model: Transient model with temporally-variable survival and recapture probabilities; and temporally-constant proportion of residents.

[8] $\varphi_t p\tau_t$ Model: Transient model with temporally-variable survival probability and proportion of residents; and temporally-constant recapture probability.

[9] $\varphi p_t\tau_t$ Model: Transient model with temporally-variable recapture probability and proportion of residents; and temporally-constant survival probability.

[10] $\varphi_t p_t\tau_t$ Model: Transient model with temporally-variable survival probability, recapture probability, and proportion of residents.

[11] $\Delta QAIC_C$ is defined as the difference in $\Delta QAIC_C$ between the $\varphi p\tau$ model and the $\varphi_t p\tau$ model.

* The chosen models are the model with the lowest $QAIC_C$ and the models with $QAIC_C$s within 2.0 units of the model with the lowest $QAIC_C$.

Table 11. Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using both temporally variable and time-constant models for 14 species breeding at two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes obtained from 13 years (1993-2005) of mark-recapture data.

Species	Num. sta2.[1]	Num. ind.[2]	Num. caps.[3]	Num. ret.[4]	Model[5]	$QAIC_C$[6]	Survival probability[7]	Surv. C.V.[8]	Recapture probability[9]	Proportion of residents[10]
Western Wood-Pewee †	2	28	39	6	φpτ	40.31	0.513 (0.168)	32.8	0.238 (0.175)	1.000 (0.790)
"Traill's" Flycatcher	2	98	138	8	φpτ	40.45	0.385 (0.132)	34.4	0.677 (0.249)	0.131 (0.089)
Black-capped Chickadee	2	118	215	45	φpτ	121.40	0.575 (0.059)	10.2	0.457 (0.080)	0.631 (0.157)
House Wren †	1	72	106	5	φpτ	36.85	0.354 (0.176)	49.7	0.140 (0.144)	1.000 (0.998)
Swainson's Thrush	1	34	53	7	φpτ	46.54	0.606 (0.133)	21.9	0.373 (0.177)	0.310 (0.209)
American Robin	2	115	146	14	φpτ	71.64	0.679 (0.104)	15.4	0.293 (0.109)	0.218 (0.104)
Gray Catbird	2	121	168	15	φpτ	74.57	0.502 (0.118)	23.5	0.215 (0.107)	0.687 (0.371)
Yellow Warbler	2	96	156	20	φpτ	95.79	0.607 (0.091)	15.0	0.258 (0.090)	0.598 (0.241)
Common Yellowthroat	1	75	131	24	φpτ	101.20	0.575 (0.077)	13.5	0.310 (0.093)	0.841 (0.302)
Spotted Towhee ‡†	2	31	42	2	φpτ	20.39	0.453 (0.332)	73.2	0.088 (0.141)	1.000 (1.528)
Chipping Sparrow ‡†	2	58	71	6	φpτ	34.80	0.274 (0.174)	63.5	0.377 (0.346)	1.000 (1.100)
Song Sparrow	2	111	212	32	φpτ	80.90	0.483 (0.072)	14.8	0.687 (0.110)	0.442 (0.140)
Lazuli Bunting	1	59	101	16	φpτ	68.99	0.466 (0.109)	23.3	0.572 (0.167)	0.644 (0.276)
Brown-headed Cowbird	2	31	40	6	φpτ	37.64	0.456 (0.170)	37.3	0.360 (0.236)	0.710 (0.547)

[1] Number of stations where the species was a regular or usual breeder and at which adults of the species were captured. Stations within one km of each other were combined into a single super-station to prevent individuals whose home ranges included portions of two or more stations from being counted as multiple individuals.

Table 11. Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using both temporally variable and time-constant models for 14 species breeding at two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes obtained from 13 years (1993-2005) of mark-recapture data.

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[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] Models included are those chosen by $QAIC_C$ (those models marked with * in Table 10) plus the $\varphi p \tau$ model in all cases. See Table 10 for definitions of the models.
[6] Akaike Information Criterion ($QAIC_C$) given as -2(log-likelihood) + 2(number of estimable parameters) with corrections for small sample size and over dispersion of data.
[7] Survival probability (φ) presented as the maximum likelihood estimate (standard error of the estimate).
[8] The coefficient of variation for survival probability, CV(φ).
[9] Recapture probability (p) presented as the maximum likelihood estimate (standard error of the estimate).
[10] The proportion of residents among newly captured adults (τ) presented as the maximum likelihood estimate (standard error of the estimate).

‡ The estimate for survival probability should be viewed with caution because it is based on fewer than five between-year recaptures, or the estimate is very imprecise (SE(φ)>0.200 or CV(φ)>50.0%).
† The estimate for recapture probability (and possibly survival probability as well) may be biased low because the estimate for τ was 1.000.

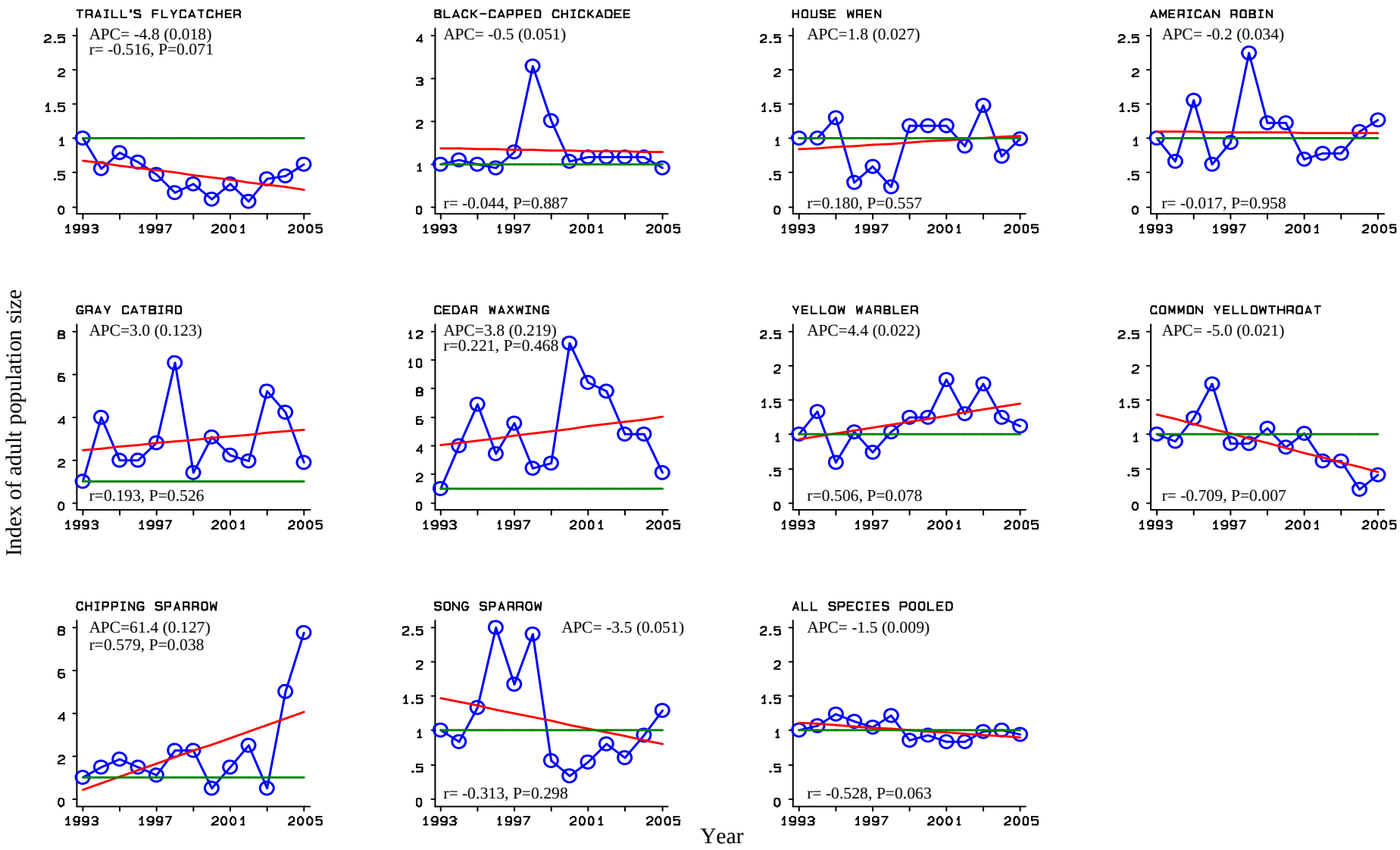

Figure 1. Population trends for ten species and all species pooled from two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the 13 years 1993-2005. The index of population size was arbitrarily defined as 1.0 in 1993. Indices 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.

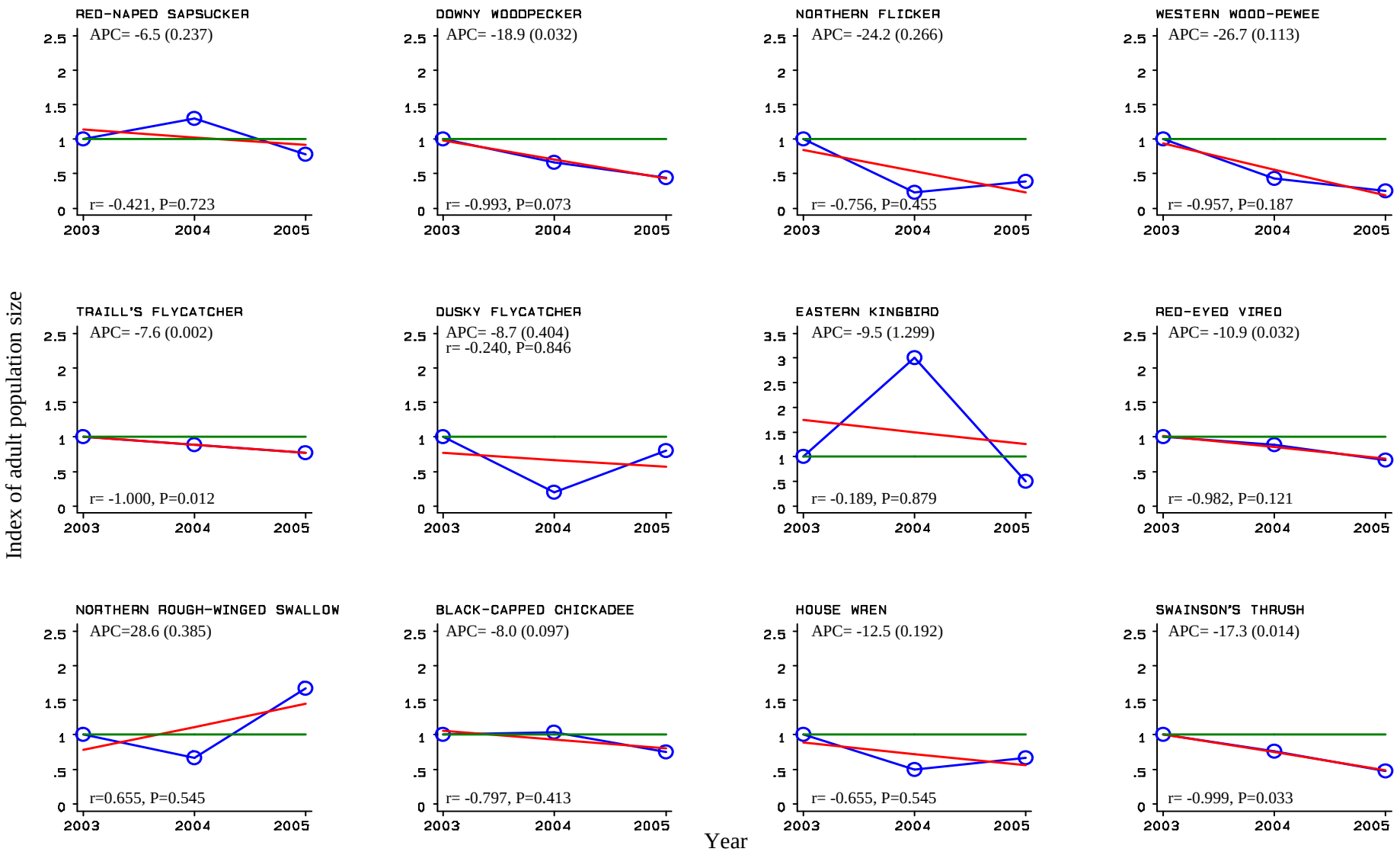

Figure 2. Population trends for 26 species and all species pooled from the six MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the three years 2003-2005. The index of population size was arbitrarily defined as 1.0 in 2003. Indices for subsequent years were 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.

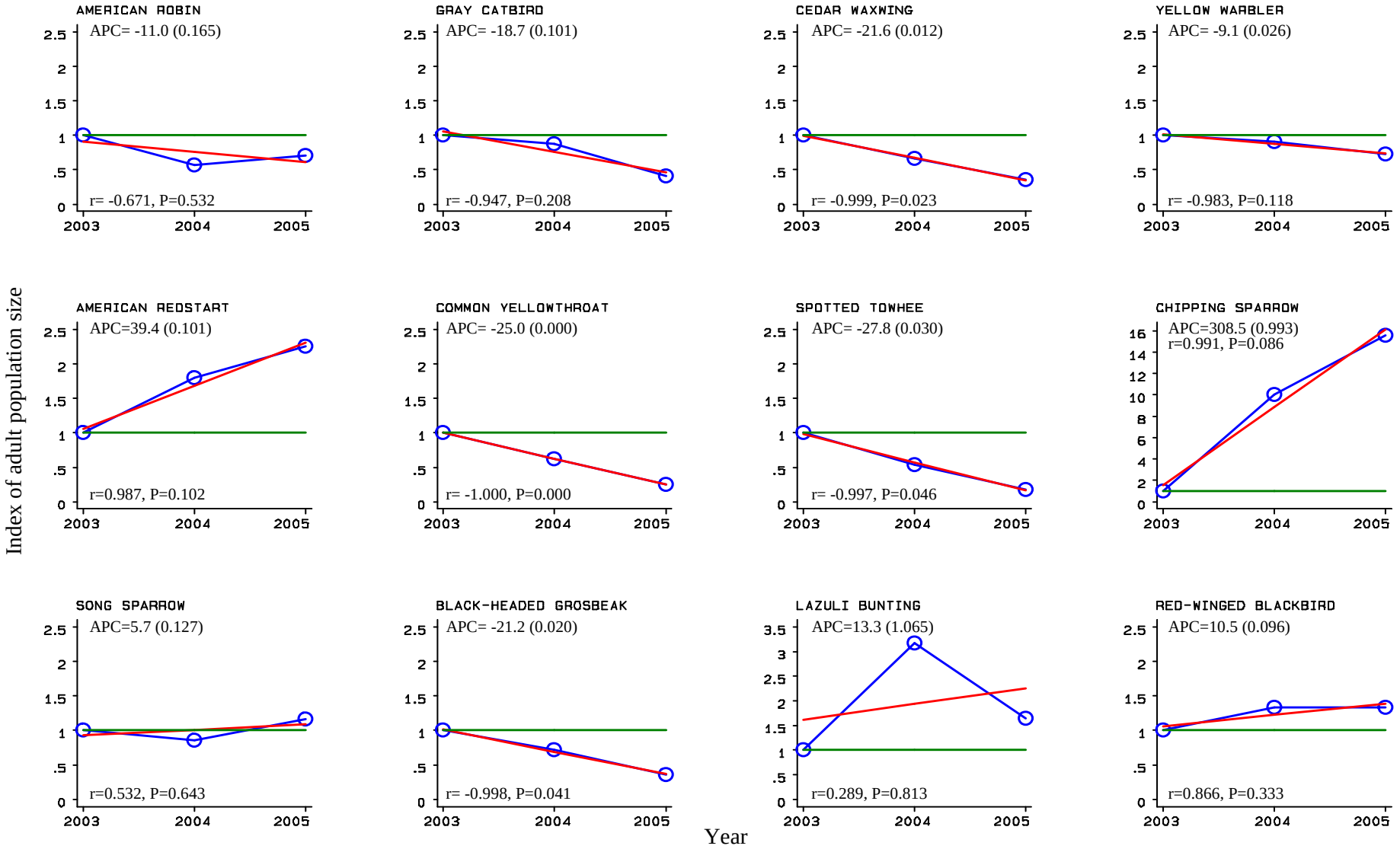

Figure 2. (cont.) Population trends for 26 species and all species pooled from the six MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the three years 2003-2005. The index of population size was arbitrarily defined as 1.0 in 2003. Indices for subsequent years 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.

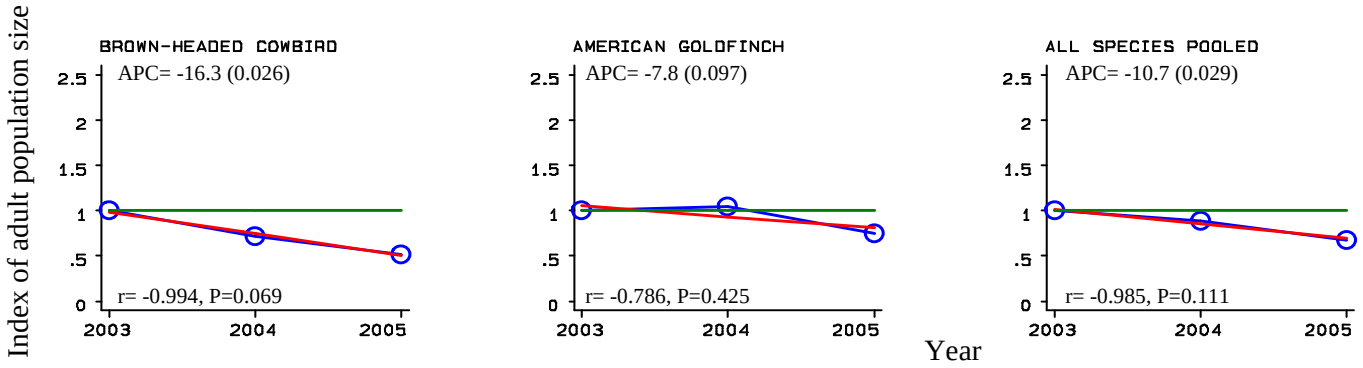

Figure 2. (cont.) Population trends for 26 species and all species pooled from the six MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the three years 2003-2005. The index of population size was arbitrarily defined as 1.0 in 2003. Indices for subsequent years 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.

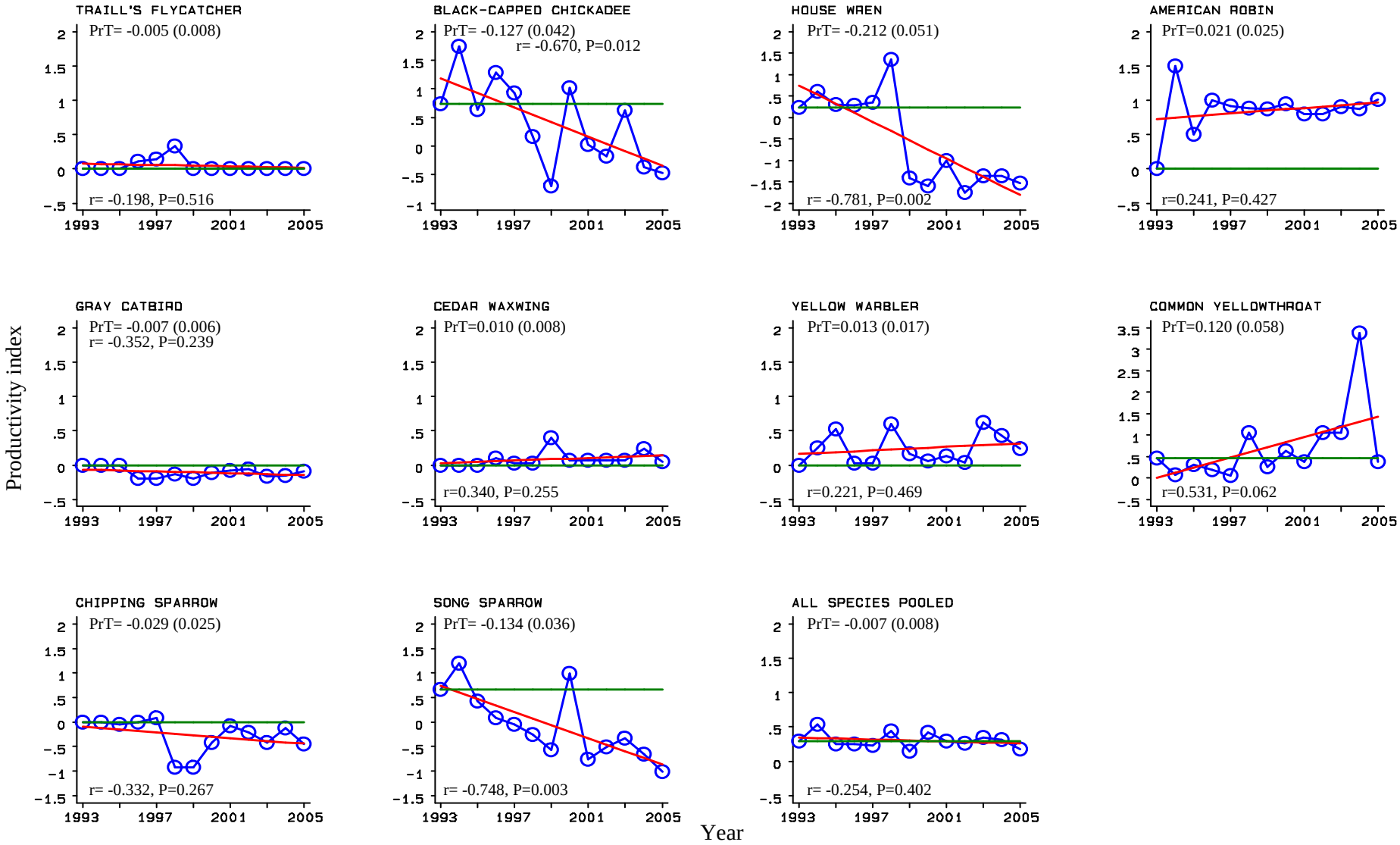

Figure 3. Trend in productivity for ten species and all species pooled from two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the 13 years 1993-2005. The productivity index was defined as the actual productivity value in 1993. Indices for subsequent years were determined from constant-effort between-year changes in reproductive index 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.

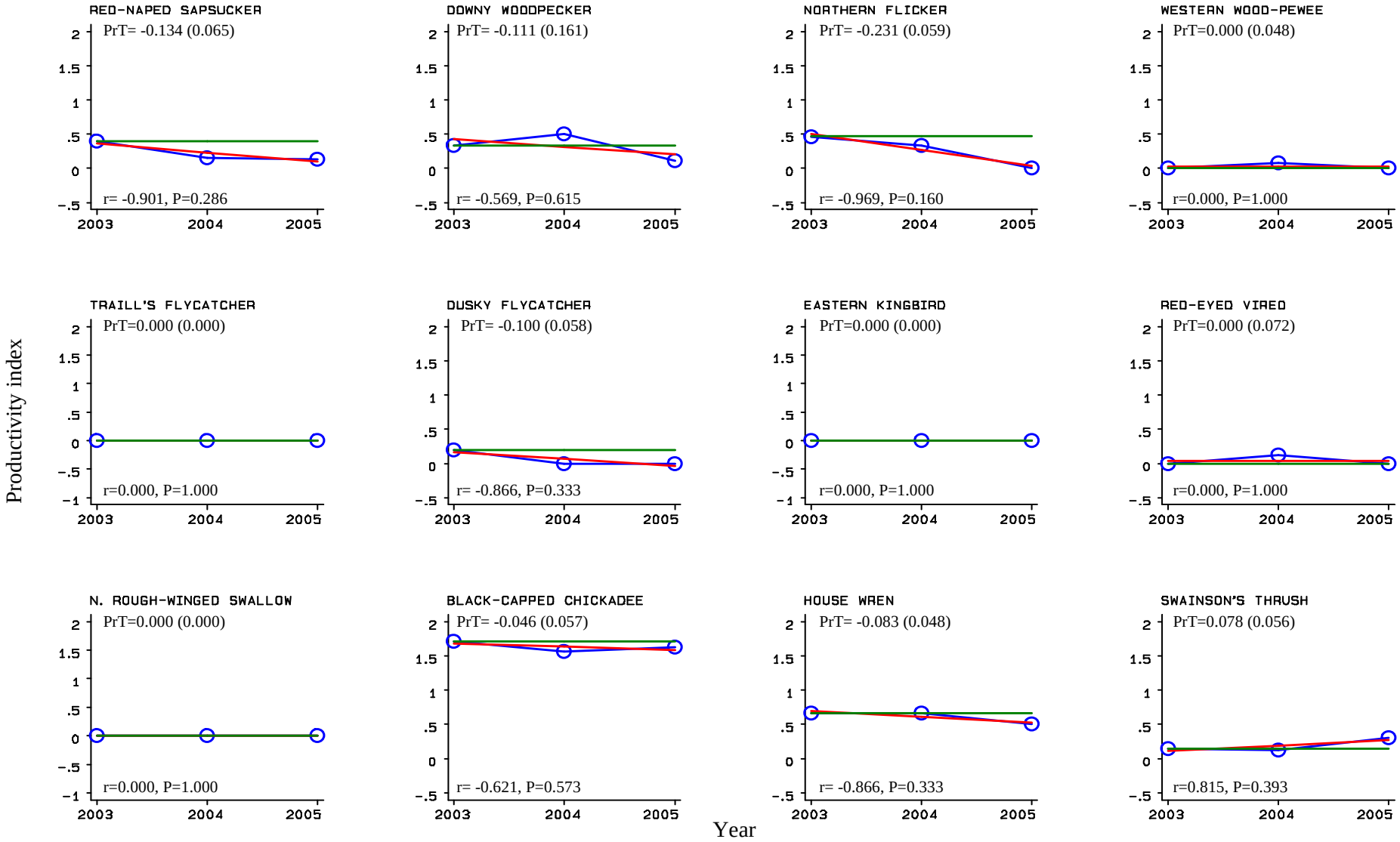

Figure 4. Trend in productivity for 26 species and all species pooled from all six MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the three years 2003-2005. The productivity index was defined as the actual productivity value in 2003. Indices for subsequent years were determined from constant-effort between-year changes in reproductive index 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.

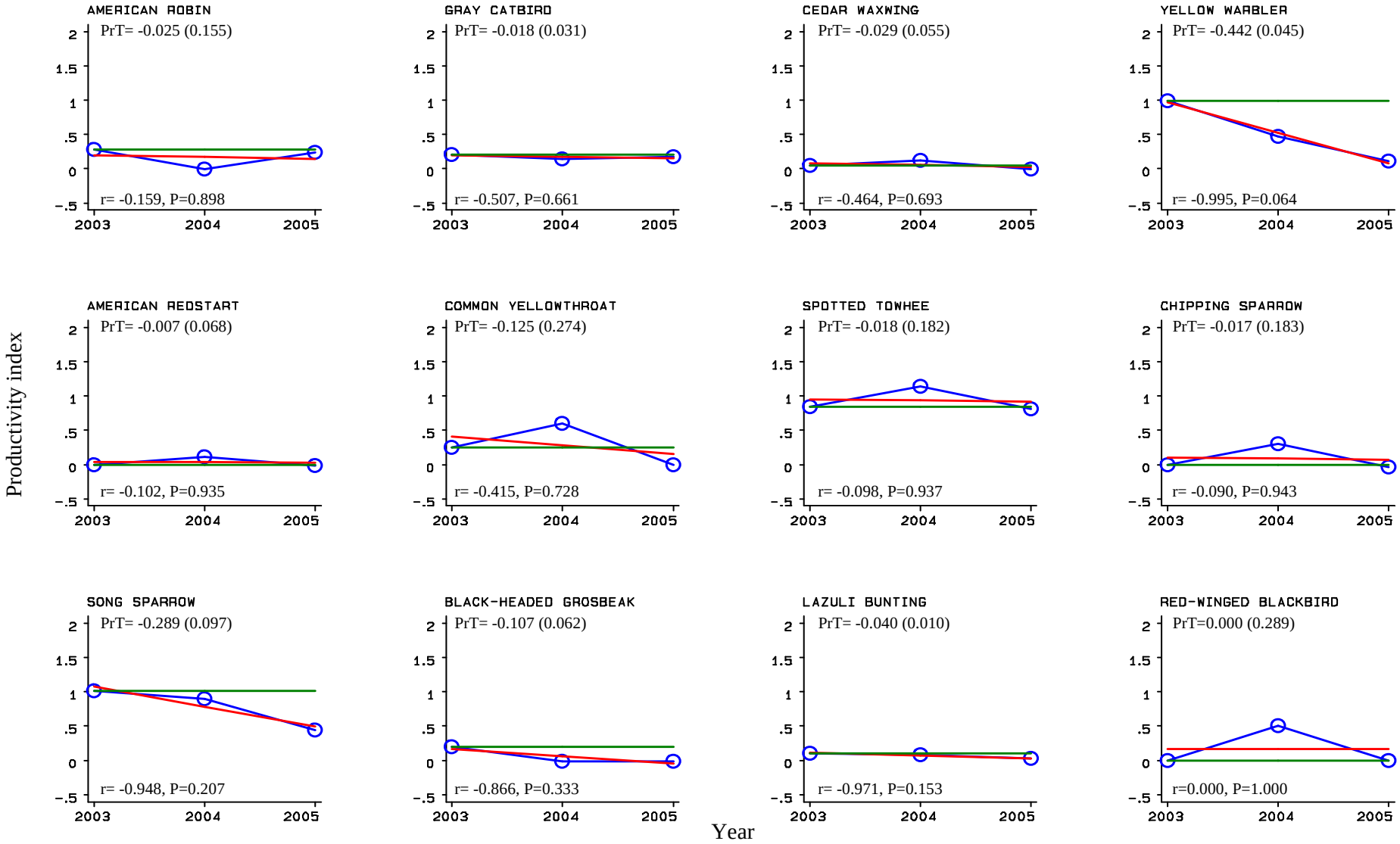

Figure 4. (cont.) Trend in productivity for 26 species and all species pooled from all six MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the three years 2003-2005. The productivity index was defined as the actual productivity value in 2003. Indices for subsequent years were determined from constant-effort between-year changes in reproductive index 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.

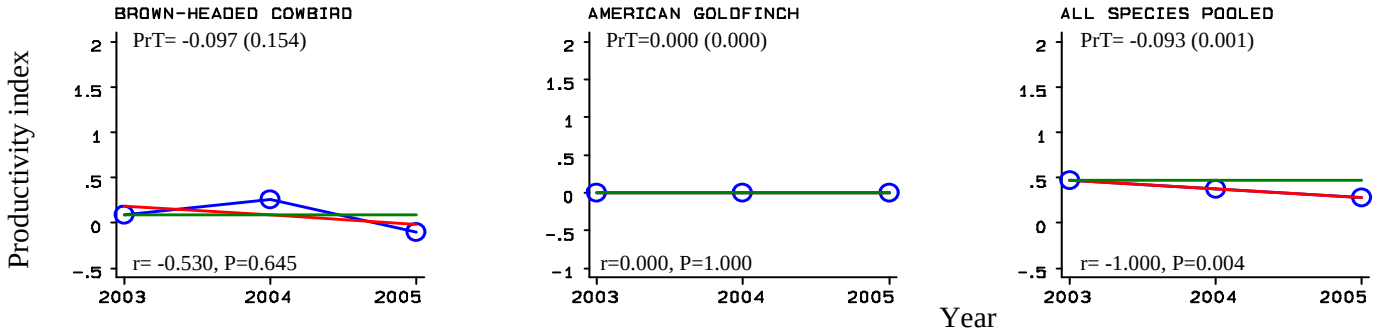

Figure 4. (cont.) Trend in productivity for 26 species and all species pooled from all six MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the three years 2003-2005. The productivity index was defined as the actual productivity value in 2003. Indices for subsequent years were determined from constant-effort between-year changes in reproductive index 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.

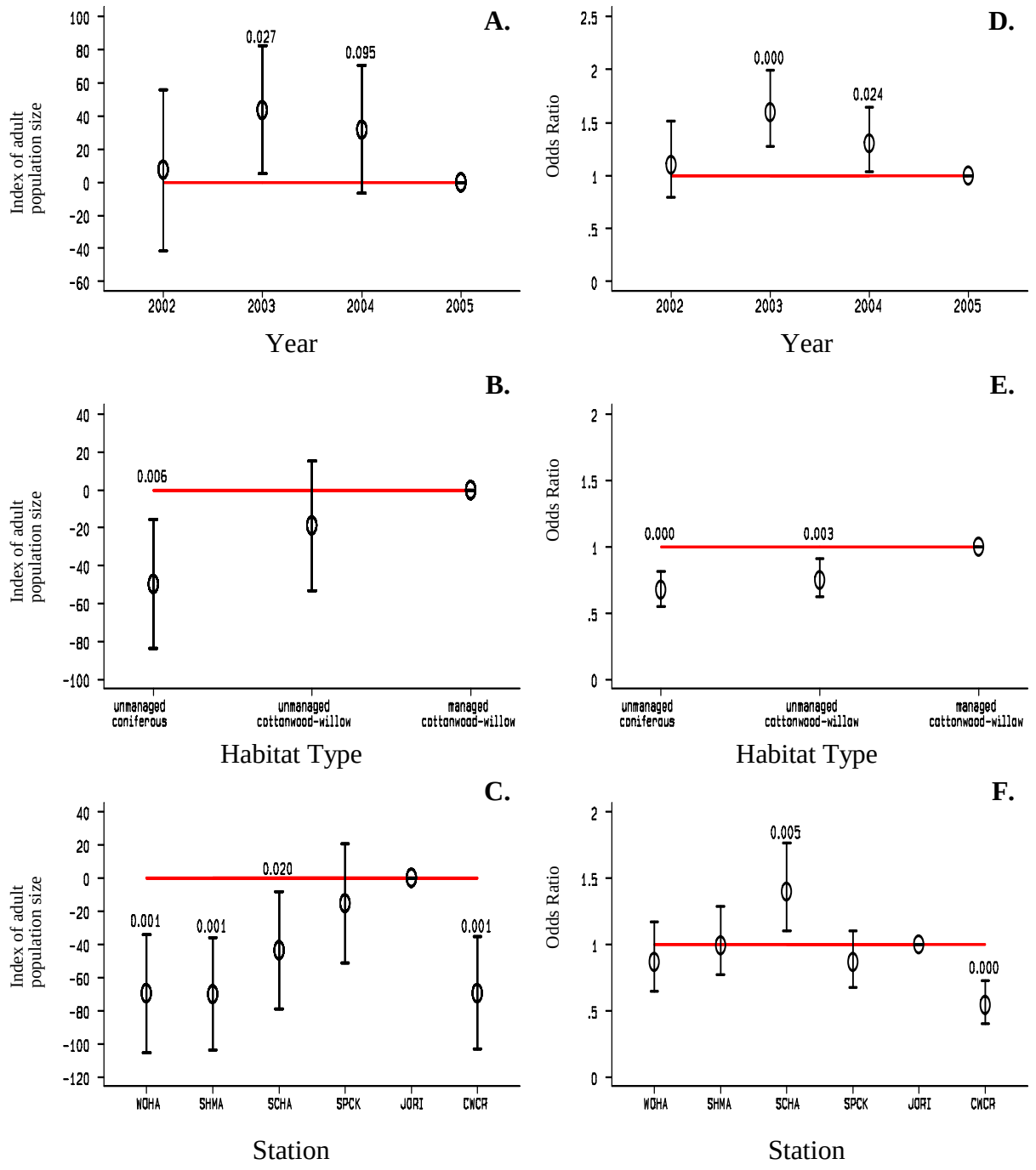

Figure 5. Predicted relative mean numbers of adults (A-C) and odds ratios for productivity indices (D-F), with 95% confidence intervals, for **ALL SPECIES POOLED**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours) and the odds ratios for each design variable were estimated using multivariate logistic regression, thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A,B,D,E or year and station for figures C and F (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

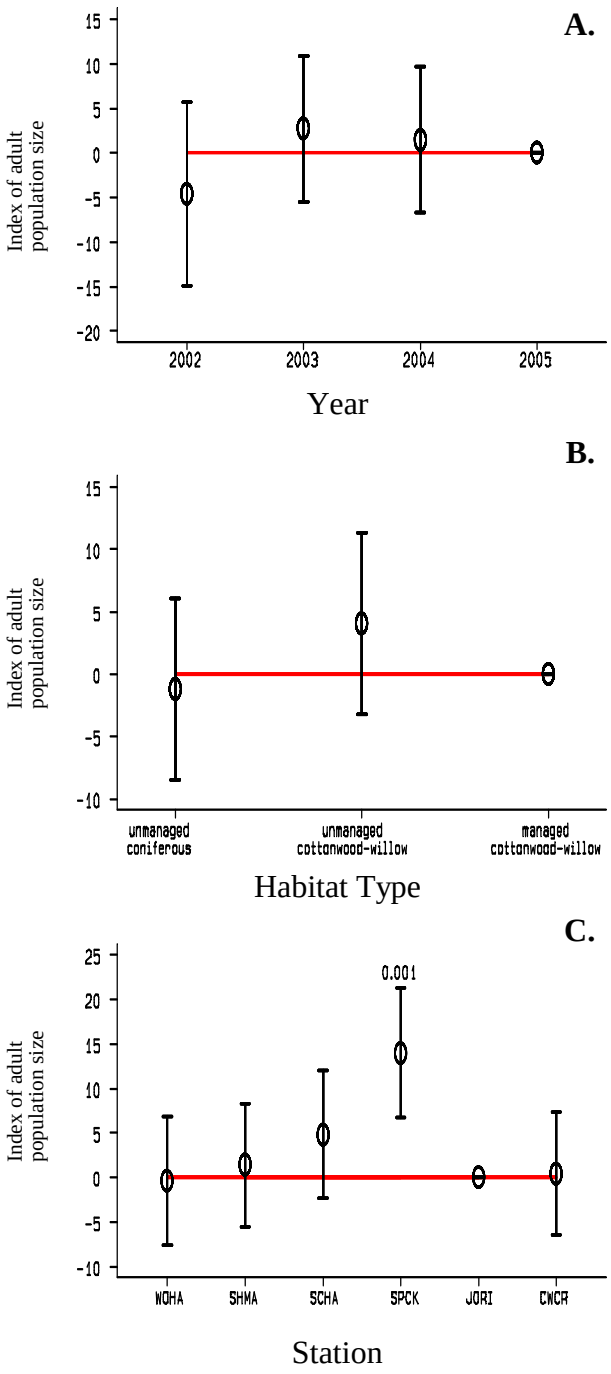

Figure 6. Predicted relative mean numbers of adults with 95% confidence intervals for **Trail's Flycatcher**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours), thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A and B or year and station for figure C (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

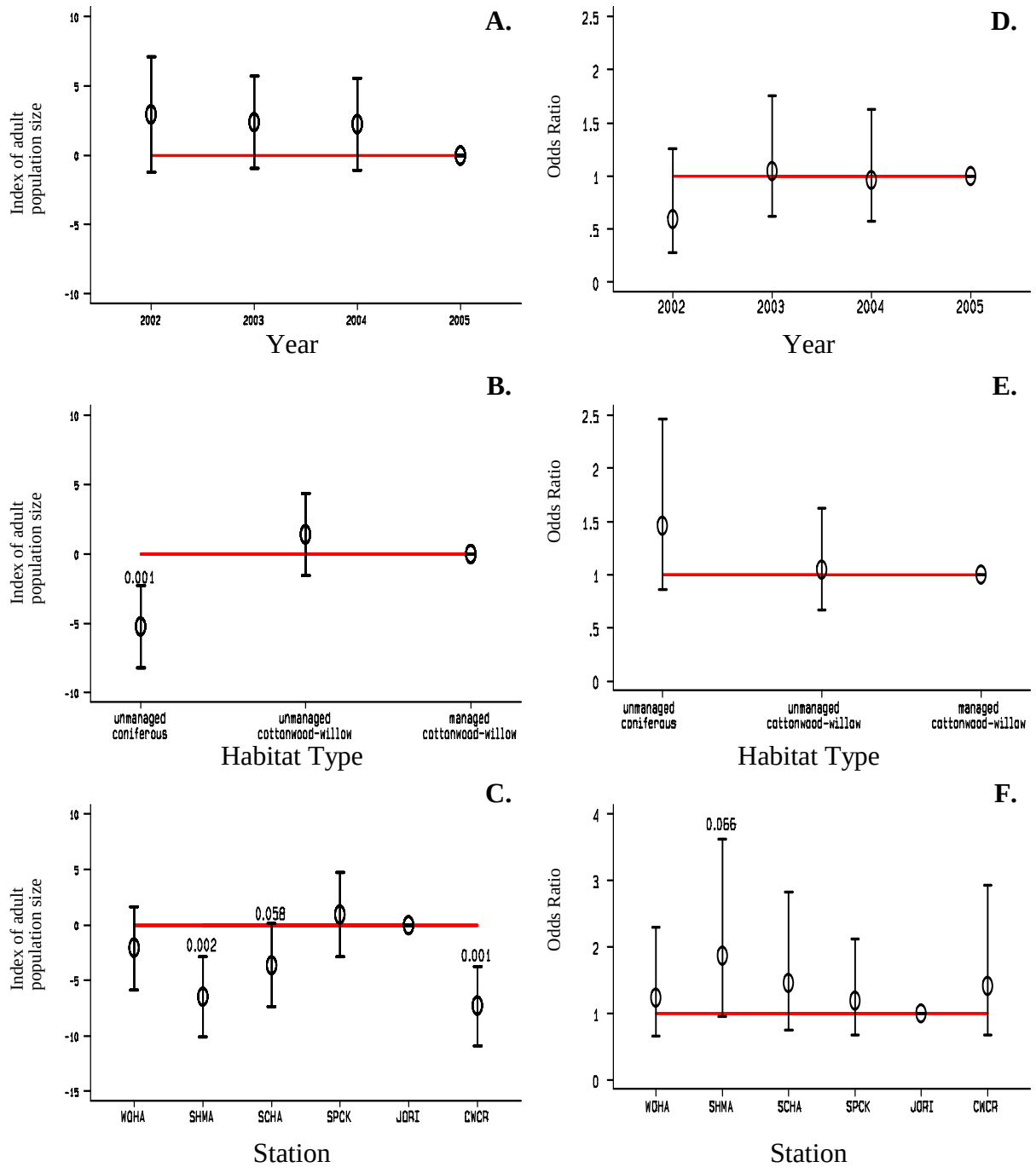

Figure 7. Predicted relative mean numbers of adults (A-C) and odds ratios for productivity indices (D-F), with 95% confidence intervals, for **Black-capped Chickadee**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours) and the odds ratios for each design variable were estimated using multivariate logistic regression, thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A,B,D,E or year and station for figures C and F (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

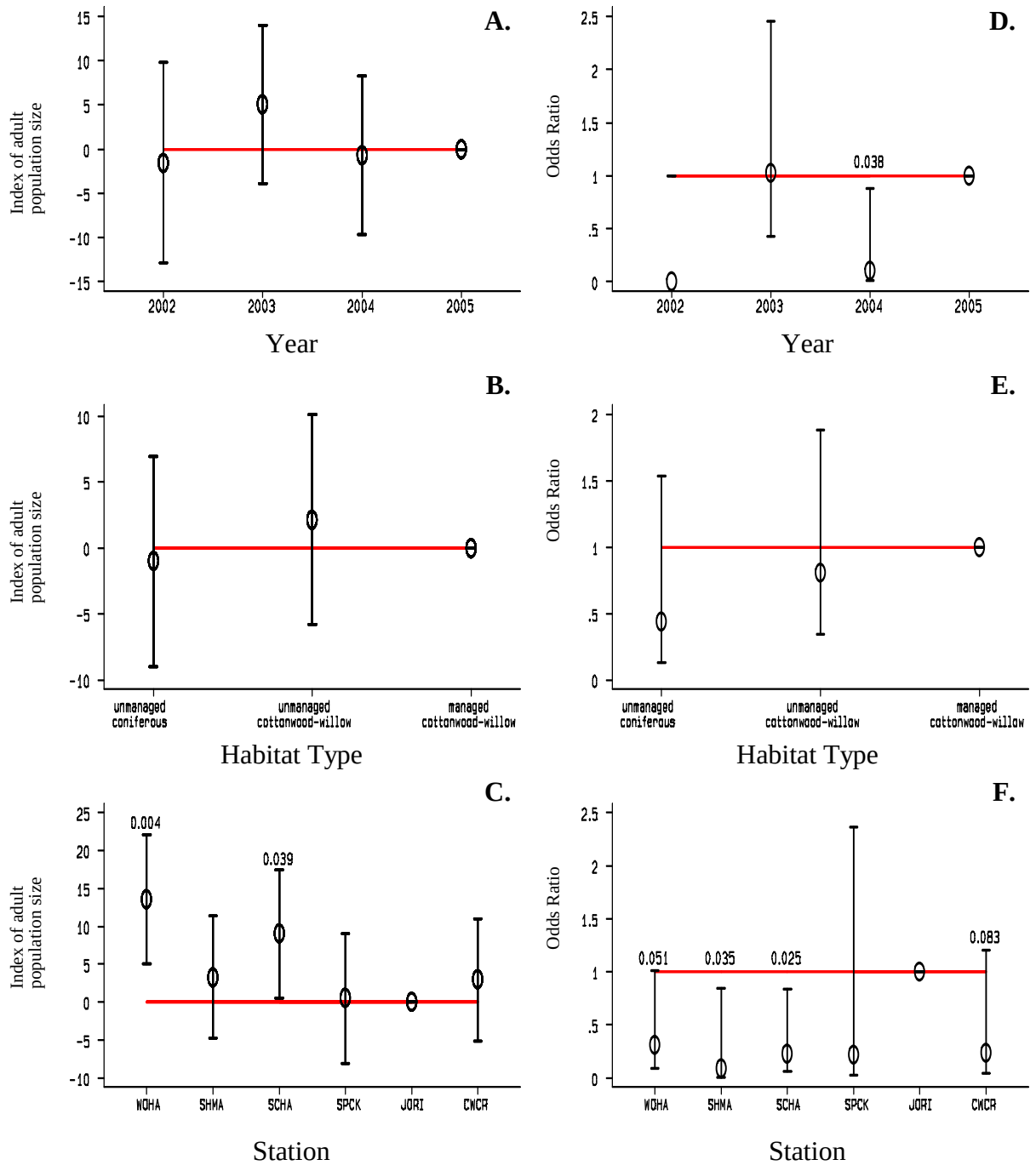

Figure 8. Predicted relative mean numbers of adults (A-C) and odds ratios for productivity indices (D-F), with 95% confidence intervals, for **American Robin**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours) and the odds ratios for each design variable were estimated using multivariate logistic regression, thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A,B,D,E or year and station for figures C and F (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

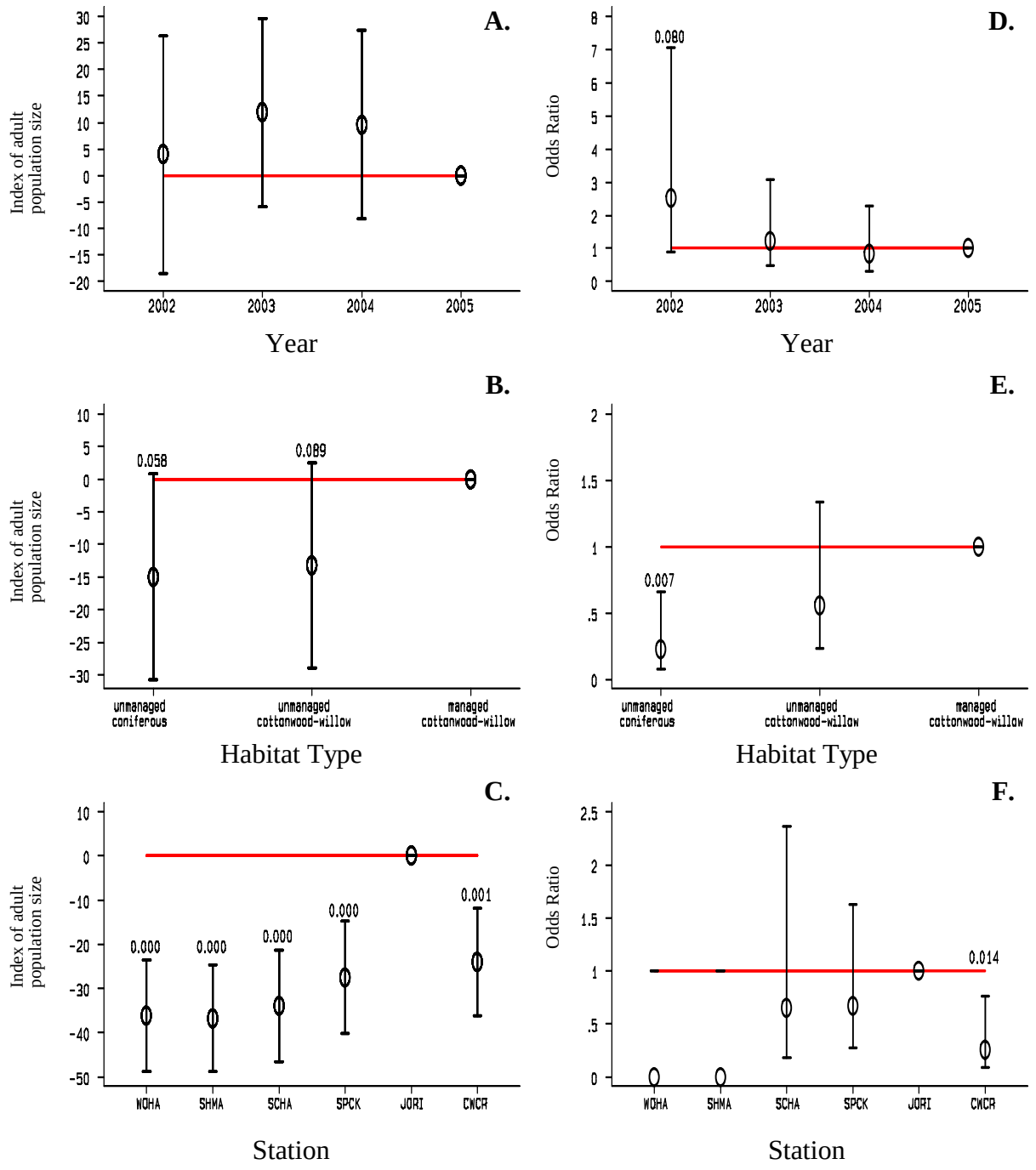

Figure 9. Predicted relative mean numbers of adults (A-C) and odds ratios for productivity indices (D-F), with 95% confidence intervals, for **Gray Catbird**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours) and the odds ratios for each design variable were estimated using multivariate logistic regression, thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A,B,D,E or year and station for figures C and F (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

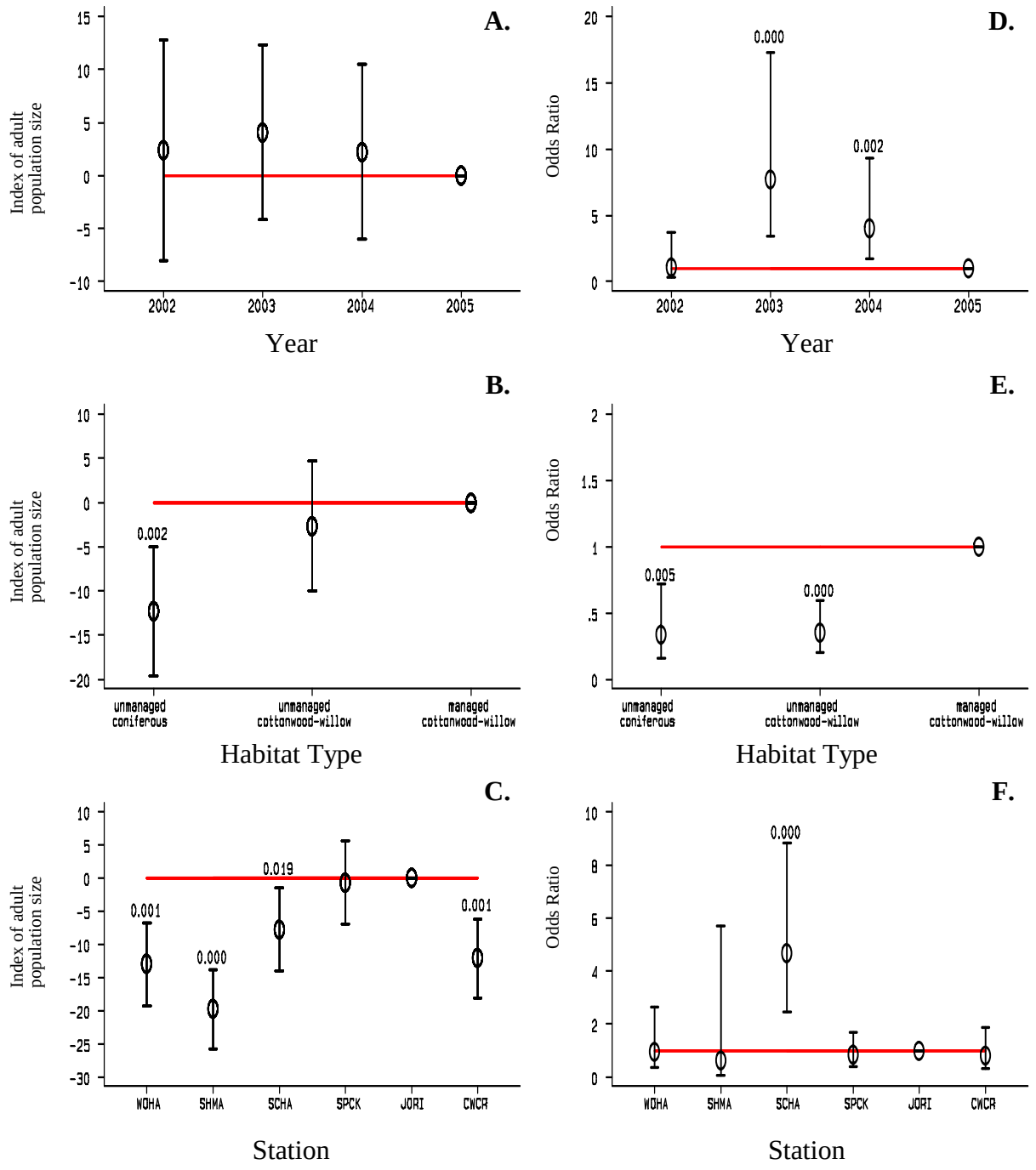

Figure 10. Predicted relative mean numbers of adults (A-C) and odds ratios for productivity indices (D-F), with 95% confidence intervals, for **Yellow Warbler**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours) and the odds ratios for each design variable were estimated using multivariate logistic regression, thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A,B,D,E or year and station for figures C and F (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

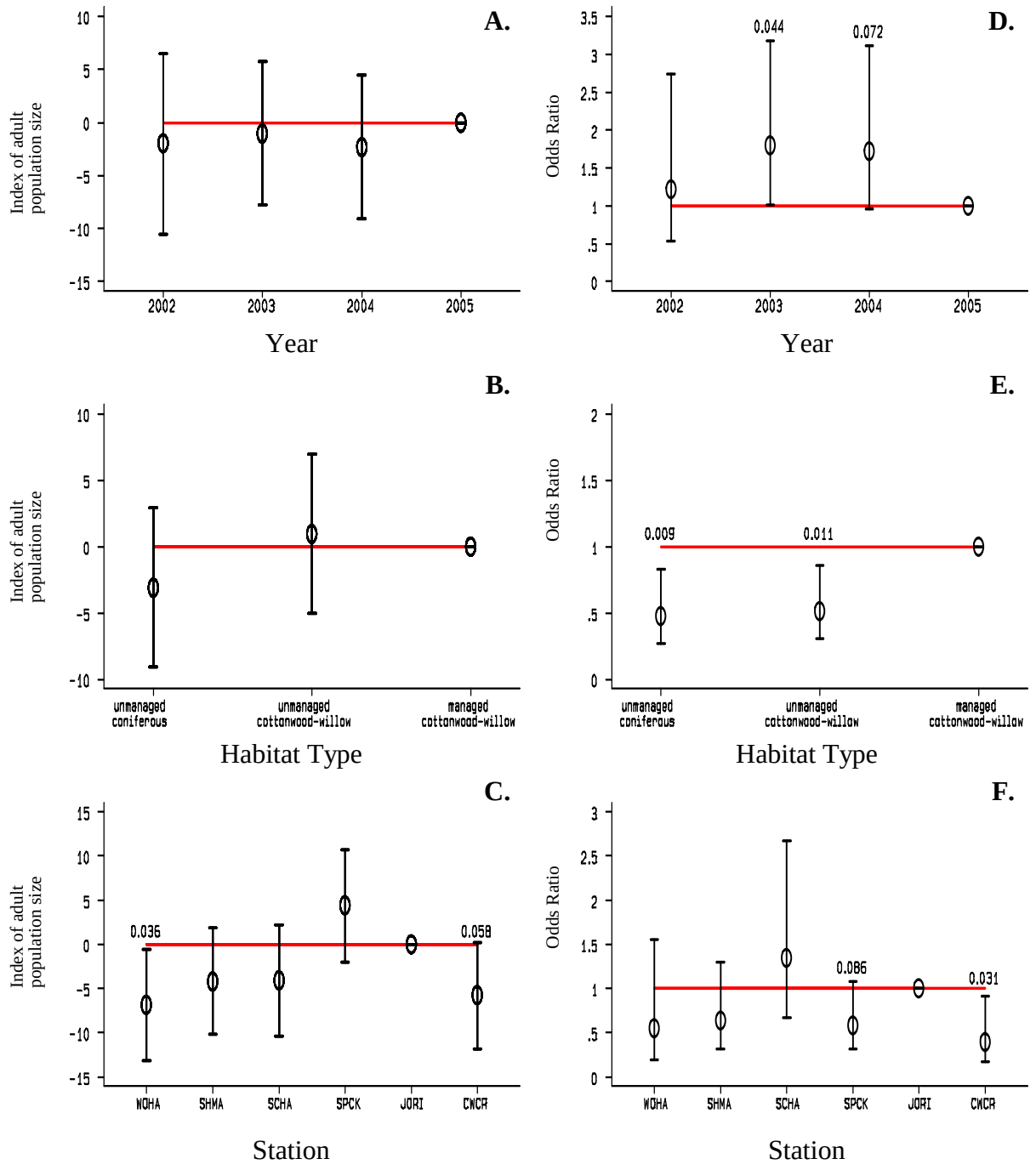

Figure 11. Predicted relative mean numbers of adults (A-C) and odds ratios for productivity indices (D-F), with 95% confidence intervals, for **Song Sparrow**, captured at six stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Relative mean numbers were estimated using multivariate ANOVA (controlling for the number of net hours) and the odds ratios for each design variable were estimated using multivariate logistic regression, thus controlling for the other variables while calculating the differences in the target variable. The variables included were year and habitat for figures A,B,D,E or year and station for figures C and F (see text). For each variable, the estimates are compared to a reference point (lacking a 95% confidence interval), and the reference point and a reference line are plotted for ease of comparison. WOHA - Woodpecker Haven, SHMA - Safe Harbor Marsh, SCHA - Schall, SPCK - Spring Creek, JORI - Jocko River, and CWCR - Crow Creek.

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 13 years, 1993-2005, of the MAPS Program on the six stations ever operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes.

NUMB	SPEC	SPECIES NAME
00130	PBGR	Pied-billed Grebe
00860	DCCO	Double-crested Cormorant
01010	GBHE	Great Blue Heron
01300	TUVU	Turkey Vulture
01460	CANG	Canada Goose
01570	WODU	Wood Duck
01580	GADW	Gadwall
01630	MALL	Mallard
01760	CANV	Canvasback
01930	BUFF	Bufflehead
01980	COME	Common Merganser
02015	UNDU	Unidentified Duck
02020	OSPR	Osprey
02130	BAEA	Bald Eagle
02170	NOHA	Northern Harrier
02200	SSHA	Sharp-shinned Hawk
02210	COHA	Cooper's Hawk
02245	UNAH	Unidentified Accipiter Hawk
02460	RTHA	Red-tailed Hawk
02630	AMKE	American Kestrel
02710	PRFA	Prairie Falcon
02920	RNEP	Ring-necked Pheasant
02940	RUGR	Ruffed Grouse
03000	BLUG	Blue Grouse
03040	WITU	Wild Turkey
03370	VIRA	Virginia Rail
03780	KILL	Killdeer
04020	SPSA	Spotted Sandpiper
04460	WISN	Wilson's Snipe
04510	RNPH	Red-necked Phalarope
04690	RBGU	Ring-billed Gull
04700	CAGU	California Gull
04865	UNGU	Unidentified Gull
05370	ROPI	Rock Pigeon
05570	MODO	Mourning Dove
06800	GHOW	Great Horned Owl
06830	NOPO	Northern Pygmy-Owl
07010	SEOW	Short-eared Owl
07080	CONI	Common Nighthawk

Appendix I. continued.

NUMB	SPEC	SPECIES NAME
08640	BCHU	Black-chinned Hummingbird
08690	CAHU	Calliope Hummingbird
08720	BTAH	Broad-tailed Hummingbird
08730	RUHU	Rufous Hummingbird
08774	USHU	Unidentified Selasphorus Hummingbird
08775	UNHU	Unidentified Hummingbird
09110	BEKI	Belted Kingfisher
09390	LEWO	Lewis's Woodpecker
09570	WISA	Williamson's Sapsucker
09590	RNSA	Red-naped Sapsucker
09650	DOWO	Downy Woodpecker
09660	HAWO	Hairy Woodpecker
09800	RSFL	Red-shafted Flicker
09800	YSFL	Yellow-shafted Flicker
09860	PIWO	Pileated Woodpecker
09915	UNWO	Unidentified Woodpecker
11340	OSFL	Olive-sided Flycatcher
11380	WEWP	Western Wood-Pewee
11475	TRFL	Traill's Flycatcher
11475	WIFL	Willow Flycatcher
11500	LEFL	Least Flycatcher
11510	HAFL	Hammond's Flycatcher
11530	DUFL	Dusky Flycatcher
11555	COFL	Cordilleran Flycatcher
11555	WEFL	Western Flycatcher
11595	UEFL	Unidentified Empidonax Flycatcher
12020	WEKI	Western Kingbird
12030	EAKI	Eastern Kingbird
12710	CAVI	Cassin's Vireo
12760	WAVI	Warbling Vireo
12790	REVI	Red-eyed Vireo
13150	CLNU	Clark's Nutcracker
13160	BBMA	Black-billed Magpie
13190	AMCR	American Crow
13300	CORA	Common Raven
13410	TRES	Tree Swallow
13440	VGSW	Violet-green Swallow
13490	NRWS	Northern Rough-winged Swallow
13510	BANS	Bank Swallow
13520	CLSW	Cliff Swallow
13540	BARS	Barn Swallow
13555	UNSW	Unidentified Swallow

Appendix I. continued.

NUMB	SPEC	SPECIES NAME
13570	BCCH	Black-capped Chickadee
13580	MOCH	Mountain Chickadee
13690	RBNU	Red-breasted Nuthatch
13700	WBNU	White-breasted Nuthatch
13710	PYNU	Pygmy Nuthatch
13730	BRCR	Brown Creeper
13850	CANW	Canyon Wren
14070	HOWR	House Wren
14110	WIWR	Winter Wren
14130	MAWR	Marsh Wren
14210	AMDI	American Dipper
14240	GCKI	Golden-crowned Kinglet
14250	RCKI	Ruby-crowned Kinglet
14590	TOSO	Townsend's Solitaire
14780	VEER	Veery
14810	SWTH	Swainson's Thrush
14835	UNTH	Unidentified Thrush
15000	AMRO	American Robin
15130	GRCA	Gray Catbird
15370	EUST	European Starling
15550	CEDW	Cedar Waxwing
15650	TEWA	Tennessee Warbler
15660	OCWA	Orange-crowned Warbler
15670	NAWA	Nashville Warbler
15750	YWAR	Yellow Warbler
15800	AUWA	Audubon's Warbler
15840	TOWA	Townsend's Warbler
16040	AMRE	American Redstart
16090	NOWA	Northern Waterthrush
16140	MGWA	MacGillivray's Warbler
16150	COYE	Common Yellowthroat
16290	WIWA	Wilson's Warbler
16460	YBCH	Yellow-breasted Chat
16495	UNWA	Unidentified Warbler
16840	WETA	Western Tanager
17810	SPTO	Spotted Towhee
18020	CHSP	Chipping Sparrow
18080	VESP	Vesper Sparrow
18220	FOSP	Fox Sparrow
18230	SOSP	Song Sparrow
18240	LISP	Lincoln's Sparrow
18320	ORJU	Oregon Junco

Appendix I. continued.

NUMB	SPEC	SPECIES NAME
18610	BHGR	Black-headed Grosbeak
18660	LAZB	Lazuli Bunting
18730	RWBL	Red-winged Blackbird
18810	WEME	Western Meadowlark
18820	YHBL	Yellow-headed Blackbird
18860	BRBL	Brewer's Blackbird
18960	BHCO	Brown-headed Cowbird
18975	UNBL	Unidentified Blackbird
19105	BUOR	Bullock's Oriole
19330	PIGR	Pine Grosbeak
19350	PUFI	Purple Finch
19360	CAFI	Cassin's Finch
19370	HOFI	House Finch
19380	RECR	Red Crossbill
19430	PISI	Pine Siskin
19510	AMGO	American Goldfinch
19580	EVGR	Evening Grosbeak
19920	HOSP	House Sparrow