THE 2004 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, or on federally managed public or private lands, such as national forests, national parks, and military installations. 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.

We operated six MAPS stations in 2004 on the Flathead Reservation, in the exact 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 2003. 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 1400 captures of 53 landbird species was recorded at the six stations during the summer of 2004.

Constant-effort comparisons indicated that both population sizes and productivity of breeding landbirds decreased slightly and non-significantly at Flathead Reservation between 2003 and 2004. Both adult population size and productivity were very high during the 2003 season, a dry and warm summer during which vegetation at the stations remained moist and lush through the period. It is possible that cooler and wetter conditions in 2004 suppressed insect abundance, leading to relatively small decreases in landbird breeding effort and (especially) productivity. It was also noted that unusual numbers of adult American Robins were attracted to the area in 2003 by the tilling of old hay fields. Given these considerations, both population sizes and productivity were relatively good at Flathead during the 2004 season.

The 12-year (1993-2004) reproductive index for all species pooled at the two long-running stations (Crow Creek and Safe Harbor Marsh), 0.31, 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, 11 of 14 target species showed substantially lower productivity at Flathead than in the Northwest Region and the only species showing substantially higher productivity at Flathead was Brown-headed Cowbird. These results strongly suggest that landbird productivity is substantially 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, Yellow Warbler, Song Sparrow, and Lazuli Bunting, are known to be frequent hosts to cowbird parasitism.

Four new stations were established at Flathead in 2002 and 2003 in areas subject to on-going and proposed habitat restoration efforts along the Jocko River, aimed at restoring the adjoining cottonwood/willow riparian habitat to a continuos strip. Between 2003 and 2004, both breeding populations and productivity of all species pooled, at both Jocko River and Schall, decreased by larger amounts than recorded at all six stations combined. 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 had not matured by the summer of 2004 to the point of assisting bird populations. In addition, active and substantial revegetation and stream restoration occurred upstream of the Woodpecker Haven station in 2004-2005 and is planned for the area of the station in the fall of 2005. Once more data have been collected at Schall, Jocko River, Woodpecker Haven, and Spring Creek, it will be of great interest to assess the effects of these varying habitat-restoration efforts on landbird populations, after climate variables have been statistically controlled.

Twelve-year (1993-2004) analyses of breeding populations at Flathead indicate a substantial but non-significant decline of -1.3% per year for all species pooled at the two long-running stations (Crow Creek and Safe Harbor Marsh) combined. Populations of"Traill's" Flycatcher, Common Yellowthroat, and Song Sparrow showed substantially declining trends whereas those of Yellow Warbler, Gray Catbird, Cedar Waxwing, and Chipping Sparrow showed substantial increasing trends. Twelve-year analyses of reproductive index at the two stations also indicate a slight and non-significant long-term decline in productivity, of 0.4% per year for all species pooled. Black-capped Chickadee, House Wren, Gray Catbird, and Song Sparrow showed substantially declining productivity trends whereas Cedar Waxwing and Common Yellowthroat showed substantially increasing productivity trends.

We obtained survivorship estimates for 14 target species on Flathead Reservation, using data from just the two long-running stations. Mean coefficients of variation indicated continued improvement of the precision of our survival estimates, even after 12 years of data have been collected. Mean adult survival at Flathead Reservation in 1993-2004 (0.500) was comparable to that of the Northwestern MAPS region as a whole in 1992-2001 (0.497). 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).

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, indicating 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. It appears as though low productivity may also be driving the generally

negative population trends on six national forests in Forest Service Region Six (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 planned, will increase nest cover and decrease edge habitat, which in turn should help reduce parasitism by cowbirds.

The third species showing declines at Flathead, 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. In the near future we will be able to assess these parameters by performing survival analyses in reverse (to estimate recruitment) and, if possible, by taking into account individuals aged SY (one-year old) or ASY (two years old or older) among the data.

We have recently 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. At Flathead Reservation, we anticipate using habitat modeling to assess the effects of habitat restoration both at the local scale (as correlated with planned revegetation and stream restoration management) 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 data collected at the MAPS stations at Flathead Reservation during their first twelve years have revealed that the population dynamics of the breeding birds are complex, which underscores the importance of standardized, long-term data. We suggest that the indices and estimates of primary demographic parameters produced by MAPS are extremely useful for the management and conservation of landbirds at Flathead Reservation, and we conclude that the MAPS protocol is very well-suited to provide a critical component of natural resource management and monitoring on the Reservation. Based on the above information, we recommended that the MAPS program continue to be operate on the Reservation well into the future.

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 population 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 16th year (13th 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 2004. 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.

Goals and Objectives of MAPS

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

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

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

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

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

Recent Important Results from MAPS

Recent important results from MAPS reported in the peer-reviewed literature 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 are available in downloadable format 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 objectives and goals.

The MAPS Program on the Flathead Reservation

Both of the long-term objectives of MAPS, as described above, were found to be in agreement

with objectives 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 third and 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. In 2003 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 continuos 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 and is planned for the area of the station in the fall of 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 2004 Report

In this report we summarize results of the MAPS program at six stations on the Flathead Reservation from 1993 through 2004. For each station and for all six stations pooled, we present indices of adult population size and productivity and present constant-effort changes between 2003 and 2004 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 preliminary 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 12-year means for the indices of adult population size and productivity for each species and for all species pooled, 12-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 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) suggest future analyses to confirm these probable causes.

METHODS

Six 20-ha MAPS stations were re-established on Flathead Reservation in 2004, at the exact same locations at which they were originally established in 1993 (Safe Harbor Marsh and Crow Creek), 2002 (Jocko River), or 2003 (Woodpecker Haven, Schall, and Spring Creek). In order of decreasing elevation and from east to west, the six stations are: (1) the Woodpecker Haven station, located in cottonwood-willow riparian habitat at 920 m elevation along the Jocko River across from the Arlee Fish Hatchery; (2) the Safe Harbor Marsh station, established in 1993 at 881 m elevation in mixed coniferous forest near a freshwater marsh; (3) the Schall station, located in degraded cottonwood-willow riparian habitat at 870 m elevation along the Jocko River; (4) the Spring Creek station, located in cottonwood-willow riparian habitat at 853 m elevation at the junction of Jocko River and Spring Creek; (5) the Jocko River station, established in 2002 at 850 m elevation in a cottonwood-willow riparian patch; and (6) the Crow Creek station, established in 1993 at 786 m elevation and located in a mixed pine and riparian forest interspersed by grassy meadows. 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 six stations were operated in 2004 by two field biologist interns of The Institute for Bird Populations (Loni Beyer and Ron Taylor), who received intensive training from Institute staff field biologists Tim Pitz, Liz Moseman, and Aaron Hobden and intermittent supervision through the season from 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 eight 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 very 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 2004, and during all preceding years, followed the highly standardized protocols developed by The Institute for Bird Populations for use by the MAPS Program throughout North America and spelled out in the MAPS Manual (DeSante et al. 2004a; 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. 2004a; 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.

For each of the six stations operated, simple habitat maps were prepared on which up to four major habitat types, as well as the locations of all structures, roads, trails, and streams, were identified and delineated; when suitable maps from previous years were available, these were used. The pattern and extent of cover of each major habitat type identified at each station, as well as the pattern and extent of cover of each of four major vertical layers of vegetation (upperstory, midstory, understory, and ground cover) in each major habitat type were classified into one of twelve pattern types and eleven cover categories according to guidelines detailed in the MAPS Habitat Structure Assessment Protocol, developed by IBP Landscape Ecologist, M. Philip Nott and the IBP staff (Nott et al. 2003b). Details, protocols, and forms are available at http://www.birdpop.org/MANUALS.HTM).

Computer Data Entry and Verification

The computer entry of all banding data was completed by John W. Shipman of Zoological Data Processing, Socorro, NM. The critical data for each banding record (capture code, band number, species, age, sex, date, capture time, station, and net number) were proofed by hand against the raw data and any computer-entry errors were corrected. Computer entry of effort, 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.

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

Data Analysis

To facilitate analyses, we first classified the landbird species captured in mist nets into five groups based upon their breeding (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 2004 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 2004) of

individual adult and young birds; and
(3) the reproductive index.

Following the procedures pioneered by the British Trust for Ornithology (BTO) in their CES Scheme (Peach et al. 1996), the number of adult birds captured was used as an index of adult population size. 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 of the six stations as well as all six stations combined, we calculated percent changes between 2003 and 2004 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). 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 $0.05 \leq P < 0.10$.

For each of the two stations operated for 12 years, 1993-2004, and for both of these stations combined, we calculated 12-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.

B. Analyses of trends in adult population size and productivity – We examined 12-year (1993-2004) trends in indices of adult population size and productivity for target species at the two long-running stations combined. For trends in adult population size, we first calculated adult population indices for each species for each of the 12 years based on an arbitrary starting index of 1.0 in 1993. 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 indices for adult population size

were based on percentage changes, we further calculated the annual percent change (*APC*), defined as the average change per year over the ten-year period, to provide an estimate of the population trend for the species; *APC* 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 12-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 $SE \leq 0.029$ are considered to have a non-fluctuating and non-substantial trend; and those for which absolute $r < 0.3$ and $SE > 0.029$ 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 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. 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 12 years (1993-2004) 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 ($\phi p \tau$) accounts for the existence of transient adults (dispersing and floater individuals which are only captured once) in the sample of newly captured birds, and provides survival estimates that are unbiased with respect to these transient individuals (Pradel et al. 1997). Recapture probability is defined as the conditional probability of recapturing a bird in a subsequent year that was banded in a previous year, given that it survived and returned to the place it was originally banded.

The 12 years of data allowed us to consider all possible combinations of both time-constant and time-dependent models for each of the three parameters estimated, for a total of eight models. We limited our consideration to models that produced estimates for both survival and recapture probability that were neither 0 nor 1. The goodness of fit of the models 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 the degree of annual variation in survival for each species, we calculated $\Delta QAIC_C$ as the difference between the completely time-constant model ($\phi p \tau$) and the best model with time-dependent survival but time-constant capture probability and proportion of residents ($\phi_t p \tau$); thus, $\Delta QAIC_C$ was calculated as $QAIC_C(\phi_t p \tau)$-$QAIC_C(\phi p \tau)$, with lower (or more negative) $\Delta QAIC_C$ values indicating stronger inter-annual variation in survival.

RESULTS

A total of 2440.2 net-hours was accumulated at the six MAPS stations operated on the Flathead Reservation in 2004, of which 2319.5 net-hours could be compared with data from 2003 in a constant-effort manner (Table 1).

Indices of Adult Population Size and Post-fledging Productivity

A. 2004 values – The 2004 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 1400 captures of 53 species was recorded during the summer of 2004. Newly banded birds comprised 62.4% of the total captures. The greatest number of total captures (328) was recorded at the Sping Creek station and the smallest number of total captures (156) was recorded at the Woodpecker Haven station. The highest species richness occurred at Schall (34 species) and the lowest species richness occurred at Safe Harbor Marsh and Jocko River (27 species each).

The capture rates (per 600 net-hours) of individual adult and young birds and the percentage of young in the catch during 2004 are presented for each species and for all species pooled at each of the six stations on the Flathead Reservation in Table 2, 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 2004 was greatest at Jocko River, followed in descending order by Spring Creek, Crow Creek, Schall, Woodpecker Haven, and Safe Harbor Marsh.

The capture rate of young (Table 3) of all species pooled at each station in 2004 followed a somewhat different sequence to that of adults: Spring Creek had the highest number followed by Schall, Jocko River, Safe Harbor Marsh, Woodpecker Haven, and Crow Creek. The reproductive index at the stations in 2004 (Tables 3; the number of young per adult) was highest at Schall (0.59) followed by Safe Harbor Marsh (0.51), Spring Creek (0.47), Woodpecker Haven (0.31), Jocko River (0.29), and Crow Creek (0.15).

Among individual species, Black-capped Chickadee was the most frequently captured species at the six stations in 2004, followed by Yellow Warbler, Gray Catbird, Song Sparrow, Lazuli Bunting, "Traill's" Flycatcher, American Robin, Calliope Hummingbird, Swainson's Thrush, Cedar Waxwing, Red-naped Sapsucker, and American Goldfinch (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 Gray Catbird, Yellow Warbler, Lazuli Bunting, Black-capped Chickadee, Song Sparrow, "Traill's" Flycatcher, American Robin, Swainson's Thrush, Cedar Waxwing, and American Goldfinch (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 2004:

Woodpecker Haven
American Robin
Lazuli Bunting
Red-naped Sapsucker
Yellow Warbler
Black-capped Chickadee
American Goldfinch

Spring Creek
Yellow Warbler
Gray Catbird
"Traill's" Flycatcher
Black-capped Chickadee
Lazuli Bunting
Swainson's Thrush
Brown-headed Cowbird
American Goldfinch
Eastern Kingbird
Cassin's Vireo
Cedar Waxwing
Common Yellowthroat
Black-headed Grosbeak

Safe Harbor Marsh
Cedar Waxwing
American Robin
Song Sparrow
Chipping Sparrow
Black-capped Chickadee
"Traill's" Flycatcher
Pine Siskin

Jocko River
Gray Catbird
Yellow Warbler
Black-capped Chickadee
Swainson's Thrush
Song Sparrow
Nashville Warbler
Red-eyed Vireo
American Redstart
Black-headed Grosbeak
American Robin
Cedar Waxwing
Lazuli Bunting

Schall
"Traill's" Flycatcher
Yellow Warbler
Lazuli Bunting
American Goldfinch
Black-capped Chickadee
American Robin
Song Sparrow
Gray Catbird
Red-naped Sapsucker

Crow Creek
Gray Catbird
Lazuli Bunting
Yellow Warbler
"Traill's" Flycatcher
Song Sparrow
American Robin
Warbling Vireo
Black-capped Chickadee
Cedar Waxwing
Common Yellowthroat

B. Comparisons between 2003 and 2004 – Constant-effort comparisons between 2003 and 2004 were undertaken at all six stations, for numbers of adult birds captured (adult population size; Table 5), numbers of young birds captured (Table 6), and number of young per adult (reproductive index; Table 7). Adult population size for all species pooled for all stations combined decreased slightly, and non-significantly, by -6.5% (Table 5). Thirty of 54 species showed decreases, a proportion not significantly greater than 0.50. Decreases between 2003 and 2004 were recorded at four of the six stations, by amounts ranging from -5.5% at Spring Creek to -19.7% at Schall, whereas they increased by +1.3% at Woodpecker Haven and +22.6% at Crow Creek. The proportion of decreasing or increasing species was not significantly greater than 0.50 at any station. Near-significant or significant decreases in the number of adults captured for all stations combined was recorded for eight species (Downy Woodpecker, Northern Flicker, Western Wood-Pewee, Least Flycatcher, American Robin, Gray Catbird, Yellow Warbler, and Spotted Towhee) whereas only one species (Lazuli Bunting) showed such an increase.

Captures of young birds for all species pooled and for all stations combined decreased by a fairly substantial but non-significant -25.3% between 2003 and 2004 (Table 6). Twenty-five of 41 species showed decreases, a proportion not significantly greater than 0.50. Number of young captured for all species pooled decreased at five of six stations, by amounts ranging from -3.7% at Woodpecker Haven to -53.2% at Jocko River, whereas it increased by +41.5% at Spring Creek. The proportion of decreasing species was near-significantly greater than 0.50 at Schall.

Six species (Northern Flicker, House Wren, American Robin, Yellow Warbler, MacGillivray's Warbler, and Spotted Towhee) whereas no species showed such increases.

Reproductive index (the number of young per adult) showed a non-significant decrease of -0.097 from 0.482 in 2003 to 0.385 in 2004 for all species pooled and all stations combined (Table 7). Decreases were recorded for 20 of 41 species, a proportion not significantly greater than 0.50. Decreases in productivity were observed four of the six stations, by amounts ranging from -0.017 at Woodpecker Haven to -0.263 at Jocko River, whereas it increased by +0.031 at Safe Harbor Marsh and by +0.162 at Spring Creek. No station recorded a proportion of increasing (or decreasing) species that was significantly greater than 0.50. Three species (Dusky Flycatcher, American Robin, and Black-headed Grosbeak) showed significant or near-significant decreases across stations and two species (Red-eyed Vireo and Chipping Sparrow) showed such increases.

Thus, in general, both population sizes and productivity decreased slightly and non-significantly between 2003 and 2004. The decrease in population size was generally species-wide whereas equal numbers of species showed increases and decreases in productivity. These decreases from 2003 were generally station-wide, although breeding populations increased substantially at Crow Creek and productivity increased substantially at Spring Creek.

C. Twelve-year and two-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 twelve-year period 1993-2004 for each of the long-running stations and for both stations pooled. Table 9 presents the same data for the two year period 2003-2004 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 0.31 during the 12-year period 1993-2004 at the two long-running stations (Table 8) is very low compared with the mean value calculated 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 presented 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; two species (Black-capped Chickadee and Common Yellowthroat) showed slightly (< 10%) higher productivity at Flathead, and only one species, Brown-headed Cowbird, showed substantially (50.0%) higher productivity at Flathead than in the Northwestern Region as a whole. Although we are not comparing exactly the same span of years (1993-2004 vs. 1993-2001), we believe that these results strongly suggest that landbird productivity is substantially lower at Flathead than it should be, and that the reason may be high levels of nest-parasitism by Brown-headed Cowbirds.

Table 9 indicates that, during 2003-2004, breeding populations were highest at the Jocko River

station, followed by Spring Creek, Schall, Crow Creek, Woodpecker Haven, and Safe Harbor Marsh. Productivity during this two year period showed a very different pattern, being highest at Schall, followed by Safe Harbor Marsh, Jocko River, Spring Creek, Woodpecker Haven, and Crow Creek. It appears as though the stations with more grassland habitat (Jocko River and Crow Creek) support higher breeding populations, whereas riparian areas may support more productivity. It will be interesting to see how these dynamics change through restoration efforts at Flathead.

D. Twelve-year trends in adult population size and productivity – "Chain" indices of adult population size for the 12 years, 1993-2004, 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. For each species, we used the slope of the regression line to calculate the Annual Percentage Change (*APC*) of the population. *APC* along with the standard error of the slope (*SE*), the correlation coefficient (*r)*, and the significance of the correlation (*P*) for each target and all species pooled are included in Figure 1.

Three species showed substantial declining population trends ($r \leq -0.3$), with those of "Traill's" Flycatcher and Common Yellowthroat being significant and that of Song Sparrow being non-significant. Four species showed substantial increasing population trends ($r \geq 0.3$), with that of Yellow Warbler being significant and those of Gray Catbird, Cedar Waxwing, and Chipping Sparrow being non-significant. The remaining three species (Black-capped Chickadee, House Wren, and American Robin) showed highly fluctuating ($SE > 0.029$) population trends with no substantial increases or decreases (absolute $r < 0.3$). Overall, six species showed positive trends while four showed negative trends. The population trend for all species pooled was substantially but non-significantly negative, and indicated an annual decline of 1.3% per year.

"Chain" indices of productivity index (number of young per adult) for each of the 12 years, 1993-2004, for these ten target species and all species pooled at the two stations are shown in Figure 2. Four species showed substantially declining trends in productivity ($r \leq -0.3$) that were highly significant for House Wren, significant for Black-capped Chickadee and Song Sparrow, and not significant for Gray Catbird. Two species showed substantially increasing trends in productivity ($r \geq 0.3$), that were 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 and non-fluctuating 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.

Estimates of Adult Survivorship

Using all 12 years of data (1993-2004) 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.

Table 10 indicates that the time-constant transient model ($\phi p \tau$) was selected over all time-dependent transient models (by having a $QAIC_C$ that was at least 2.0 $QAIC_C$ units lower than any other model) for all 14 species. $\Delta QAIC_C$ (see Methods), a measure of the degree to which adult survival varied with time over the twelve-year period, was 4.60 for Black-capped Chickadee and 3.43 for Yellow Warbler, indicating some degree of time-dependence, but not quite 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 10.07 for Lazuli Bunting to 37.55 for Spotted Towhee, indicating effectively no time-dependence in survival. Thus, survival has remained fairly constant over the past 12 years among the species at Flathead.

Table 11 presents the maximum-likelihood estimates and standard errors for annual adult survival probability, recapture probability, and the proportion of residents for the time-constant model, along with the precision (Coefficients of Variation, CV(ϕ)) of the estimates of survival probability. The mean CV(ϕ) of the time-constant survival estimates for the 14 species was 31.2. Mean CV(ϕ) for eight species after the 2003 season was 24.9, compared with 23.3 for the same eight species following the 2004 season, indicating continued improvement of the precision of our survival estimates, even after 12 years of data have been collected.

Survivorship estimates for the 14 species (Table 11), using time-constant models, ranged from a low of 0.281 for Chipping Sparrow to a high of 0.720 for American Robin, with a mean of 0.500. Recapture probability ranged from a low of 0.097 for Spotted Towhee to a high of 0.640 for Song Sparrow, with a mean of 0.359. Proportion of residents varied from a low of 0.164 for "Traill's" Flycatcher to a high of 1.000 for four species (Table 11), with a mean of 0.674.

Adult survival at Flathead Reservation in 1993-2004 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 0.500 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 OF RESULTS AND CONCLUSIONS

Constant-effort comparisons indicated that both population sizes and productivity of breeding landbirds decreased slightly and non-significantly at Flathead Reservation between 2003 and 2004. These decreases were generally both species-wide and station-wide, although breeding populations increased substantially at Crow Creek, productivity increased substantially at Spring Creek, and equal numbers of species showed increases and decreases in productivity. Both adult population size and productivity were very high during the 2003 season, a dry and warm summer during which vegetation at the stations remained moist and lush through the period (DeSante et al. 2004b). By contrast, the spring and summer of 2004 were cooler and wetter at Flathead. It is possible that insect abundance was suppressed by these cooler conditions, leading to small decreases in landbird breeding effort and (especially) productivity. It was also noted in last year's report that unusual numbers of adult American Robins were attracted to the area (especially at the Schall station) by the increased availability of invertebrates caused by the tilling of old hay fields. Captures of adult American Robins decreased between 2003 and 2004 by 65% at Schall and significantly at all six stations combined. Given these considerations, both population sizes and productivity were relatively good at Flathead during the 2004 season.

The 12-year (1993-2004) reproductive index for all species pooled at the two long-running stations (Safe Harbor Marsh and Crow Creek), 0.31, 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% with a mean of 51%) lower productivity at Flathead than in the Northwest Region, only two showed slightly higher (< 10%) productivity at Flathead, and the only species showing substantially higher (50.0%) productivity at Flathead was Brown-headed Cowbird. These results strongly suggest that landbird productivity is substantially 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 (63% lower at Flathead), Yellow Warbler (57% lower), Song Sparrow (41% 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; at the Jocko River station, revegetation efforts commenced in fall 2003 with the planting of seedling willows and cottonwoods; at Woodpecker Haven, active and substantial revegetation and stream restoration occurred upstream of the station in 2004-2005 and is planned for the area of the station in the fall of 2005; and at Spring Creek similar restoration is planned for the near future. All of 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. The two long-running stations, Safe Harbor Marsh and Crow Creek, will not be subjected to management efforts and will therefore serve as controls to help interpret the effects of management at the other stations.

Between 2003 and 2004, breeding populations of all species pooled at both Jocko River and Schall decreased by -11.2% and -19.7%, respectively, representing larger decreases than recorded at all six stations combined (-5.5%). Similarly, decreases in reproductive index at both stations (-0.263 at Jocko River and -0.183 at Schall) were greater than recorded at all six stations combined
(-0.097). 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. It is also possible that inter-annual variation in landbird population dynamics, perhaps as influenced by global climate cycles such as the El Niño/Southern and North Atlantic Oscillations (Nott et al. 2002, DeSante et al. 2004b), might be affecting landbird dynamics differently at the six stations on Flathead Reservation. Once more data have been collected at Schall, Jocko River, Woodpecker Haven, and Spring Creek, it will be of great interest to assess the effects of these various habitat-restoration efforts on landbird populations, after climate variables have been statistically controlled.

Twelve-year (1993-2004) analyses of breeding populations at Flathead indicate a substantial but non-significant decline of -1.3% per year for all species pooled at the two long-running stations combined. This may not seem severe at first, but over the 12-year period it equates to a substantial decline of over 14% 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. Twelve-year analyses of reproductive index at the two stations also indicate a slight and non-significant long-term decline in productivity, of 0.4% per year (nearly 5% over 12 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 12-year period for any species. Mean CV(ϕ) for eight species after the 2004 season was 23.3, compared with 24.9 for the same eight species following the 2003 season, indicating continued improvement of the precision of our survival estimates, even after 12 years of data have been collected. This indicates that maximum precision may not be obtained until more than 12 years of data are available (see Rosenberg 1996, Rosenberg et al.1999).

Adult survival at Flathead Reservation in 1993-2004 is comparable to that of the Northwestern

MAPS region as a whole in 1992-2001. The mean estimated survival value of 0.500 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 planned, 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. In the near future we will be able to assess these parameters by performing survival analyses in reverse (to estimate recruitment) and, if possible, by taking into account individuals aged SY (one-year old) or ASY (two years old or older) among the data.

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 the target landbird species (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). At Flathead Reservation, we anticipate using 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).

The data collected at the MAPS stations at Flathead Reservation during their first twelve 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. Our next objective will be to see whether or not current habitat restoration efforts will be able to increase productivity on the Reservation, and in turn reverse current population declines.

We suggest, therefore, that the indices and estimates of primary demographic parameters produced by MAPS are extremely useful for the management and conservation of landbirds at Flathead Reservation, and we conclude that the MAPS protocol is very well-suited to provide a critical component of natural resource management and monitoring on the Reservation. Based on the above information, we recommended that the MAPS program continue to be operate on the Reservation well into the future.

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Table 1. Summary of the 2004 MAPS program on the Flathead Reservation of the Confederated Salish and Kootenai Tribes.

Station					Avg Elev. (m)	2003 operation		
Name	Code	No.	Major Habitat Type	Latitude-longitude		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	409.7 (393.0)	7	6/05 - 8/03
Safe Harbor Marsh	SHMA	11199	Freshwater marsh, mixed conifer forest, low shrubs	47˚46'27"N,-114˚08'50"W	881	400.7 (389.3)	7	6/03 - 8/04
Schall	SCHA	11232	cottonwood-willow riparian	47˚12'57"N,-114˚08'29"W	870	406.0 (386.7)	7	6/01 - 7/31
Spring Creek	SPCK	11233	cottonwood-willow riparian	47˚14’03"N,-114˚09’48"W	853	401.3 (360.2)	7	5/31 - 7/30
Jocko River	JORI	11221	cottonwood-willow riparian, surrounded by grassland	47˚16’54"N,-114˚11’60"W	825	403.2 (387.5)	7	6/02 - 8/01
Crow Creek	CWCR	11198	Riparian, ponderosa pine woodland, grassy meadow	47˚28'16"N,-114˚16'43"W	786	419.3 (402.8)	7	6/04 - 8/02
ALL STATIONS COMBINED						2440.2 (2319.5)	7	5/31 - 8/04

[1] Total net-hours in 2004. Net-hours in 2004 that could be compared in a constant-effort manner to 2003 are shown in parentheses.

Table 2. Capture summary for the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2004. 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
Sharp-shinned Hawk																0	2	0
Ruffed Grouse								2										
Black-chinned Hummingbird		1																
Calliope Hummingbird		7			31			4			4			1			2	
Rufous Hummingbird		2						2									2	
Unidentified Hummingbird		1						1										
Lewis's Woodpecker	2																	
Red-naped Sapsucker	8		10				3		6	2		1						
Downy Woodpecker	1		2				5		2	3			3		2			1
Northern Flicker	2		2							2								
Western Wood-Pewee	4			1					4				1			3		1
"Traill's" Flycatcher	4		2	2		6	11		9	14	1	20	1			8		
Least Flycatcher	1																	
Hammond's Flycatcher							3											
Dusky Flycatcher						3	1						1			2		
"Western" Flycatcher										1						2		
Unident. Empidonax Flycat.									1									
Eastern Kingbird							1		1	4						1		
Cassin's Vireo				2						3		1						
Warbling Vireo							2			2						5		5
Red-eyed Vireo	1									1			7		5	1		
Common Raven								1										
N. Rough-winged Swallow							1									1	1	
Black-capped Chickadee	19		11	9		7	20	1	25	34		23	25	1	16	11		2
Mountain Chickadee				1														
Red-breasted Nuthatch	1												1					

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2004. 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
House Wren	1			1			1									5	1	4
Marsh Wren				4														
Swainson's Thrush				2			2			7		1	16	1	1	3		
American Robin	13	1		8	2	3	2	1	8				2		2	7	1	2
Gray Catbird	3			1			6		2	23		9	39	1	40	21		10
European Starling							1											
Cedar Waxwing	2		1	13		2				4		1	4			5		
Orange-crowned Warbler	1			3			1			3			2			1		
Nashville Warbler	2			1						12			11		1	1		
Yellow Warbler	11		4	1			26		23	30	1	21	20	1	15	9		10
Yellow-rumped Warbler				1														
American Redstart	1									3		1	7		4			
Northern Waterthrush							3											
MacGillivray's Warbler				1			2		1	3		1		1				
Common Yellowthroat				5		1	2			4		5				5		
Wilson's Warbler										1								
Yellow-breasted Chat							1			1								
Western Tanager							1			1								
Spotted Towhee				3		3							9		2	1		1
Chipping Sparrow	3			8		1							1			5		
Song Sparrow	5		1	15		6	21	1	14	19	3	14	14		9	8		5
Dark-eyed Junco				5									1	1				
Black-headed Grosbeak	2			1						4		1	2		4			
Lazuli Bunting	11		4				12		7	21		3	3		1	12	1	9
Red-winged Blackbird				5			1											

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on the Flathead Reservation of the Confederated Salish and Kootenai Tribes in 2004. 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
Brown-headed Cowbird	2			2		1	4		6	4		3	2			3		
Bullock's Oriole	1						10			3			2					
Pine Siskin				5									2			1		
American Goldfinch	6						11	1	4	4		1	3					
ALL SPECIES POOLED	107	12	37	100	33	33	154	14	113	213	9	106	179	7	102	121	10	50
Total Number of Captures		156			166			281			328			288			181	
Number of Species	25	5	9	25	2	10	27	9	15	28	4	16	25	7	13	24	7	11
Total Number of Species		29			27			34			29			27			28	

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 2004.

	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
Lewis's Woodpecker	2.9	0.0	0.00															
Red-naped Sapsucker	11.7	0.0	0.00				7.4	1.5	0.20	3.0	1.5	0.50						
Downy Woodpecker	2.9	0.0	0.00				4.4	3.0	0.67	1.5	3.0	2.00	4.5	1.5	0.33	1.4	0.0	0.00
Northern Flicker	2.9	0.0	0.00							1.5	1.5	1.00						
Western Wood-Pewee	4.4	1.5	0.33	1.5	0.0	0.00	4.4	0.0	0.00				1.5	0.0	0.00	5.7	0.0	0.00
"Traill's" Flycatcher	5.9	0.0	0.00	6.0	0.0	0.00	20.7	0.0	0.00	28.4	0.0	0.00	1.5	0.0	0.00	11.5	0.0	0.00
Least Flycatcher	1.5	0.0	0.00															
Hammond's Flycatcher							1.5	1.5	1.00									
Dusky Flycatcher				1.5	0.0	0.00	1.5	0.0	0.00				1.5	0.0	0.00	2.9	0.0	0.00
"Western" Flycatcher										1.5	0.0	0.00				2.9	0.0	0.00
Eastern Kingbird							1.5	0.0	0.00	6.0	0.0	0.00				1.4	0.0	0.00
Cassin's Vireo				3.0	0.0	0.00				6.0	0.0	0.00						
Warbling Vireo							3.0	0.0	0.00	3.0	0.0	0.00				7.2	0.0	0.00
Red-eyed Vireo	1.5	0.0	0.00							1.5	0.0	0.00	11.9	1.5	0.13	1.4	0.0	0.00
N. Rough-winged Swallow							1.5	0.0	0.00							2.9	0.0	0.00
Black-capped Chickadee	8.8	23.4	2.67	7.5	10.5	1.40	10.4	26.6	2.57	23.9	32.9	1.38	23.8	23.8	1.00	7.2	11.5	1.60
Mountain Chickadee				0.0	1.5	undf.[1]												
Red-breasted Nuthatch	1.5	0.0	0.00										0.0	1.5	undf.[1]			
House Wren	1.5	0.0	0.00	1.5	0.0	0.00	0.0	1.5	undf.[1]							4.3	2.9	0.67
Marsh Wren				0.0	6.0	undf.												
Swainson's Thrush				3.0	0.0	0.00	3.0	0.0	0.00	10.5	1.5	0.14	20.8	3.0	0.14	4.3	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 2004.

	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
American Robin	19.0	0.0	0.00	13.5	0.0	0.00	10.4	0.0	0.00				6.0	0.0	0.00	10.0	1.4	0.14
Gray Catbird	4.4	0.0	0.00	1.5	0.0	0.00	8.9	1.5	0.17	31.4	7.5	0.24	74.4	10.4	0.14	31.5	1.4	0.05
European Starling							1.5	0.0	0.00									
Cedar Waxwing	2.9	0.0	0.00	18.0	4.5	0.25				6.0	0.0	0.00	6.0	0.0	0.00	7.2	0.0	0.00
Orange-crowned Warbler	0.0	1.5	undf.[1]	3.0	1.5	0.50				0.0	4.5	undf.[1]	0.0	3.0	undf.	1.4	0.0	0.00
Nashville Warbler	1.5	1.5	1.00	0.0	1.5	undf.				3.0	15.0	5.00	14.9	1.5	0.10	0.0	1.4	undf.[1]
Yellow Warbler	10.3	5.9	0.57	0.0	1.5	undf.	20.7	22.2	1.07	37.4	13.5	0.36	31.3	8.9	0.29	14.3	2.9	0.20
Yellow-rumped Warbler				1.5	0.0	0.00												
American Redstart	1.5	0.0	0.00							3.0	1.5	0.50	10.4	0.0	0.00			
Northern Waterthrush							4.4	0.0	0.00									
MacGillivray's Warbler				1.5	0.0	0.00	4.4	0.0	0.00	3.0	1.5	0.50						
Common Yellowthroat				1.5	4.5	3.00	3.0	0.0	0.00	6.0	0.0	0.00				7.2	0.0	0.00
Wilson's Warbler										1.5	0.0	0.00						
Yellow-breasted Chat							1.5	0.0	0.00	1.5	0.0	0.00						
Western Tanager							1.5	0.0	0.00	1.5	0.0	0.00						
Spotted Towhee				4.5	1.5	0.33							4.5	10.4	2.33	1.4	0.0	0.00
Chipping Sparrow	2.9	1.5	0.50	9.0	3.0	0.33							1.5	0.0	0.00	5.7	1.4	0.25
Song Sparrow	4.4	2.9	0.67	12.0	10.5	0.88	10.4	23.7	2.29	17.9	20.9	1.17	19.4	8.9	0.46	11.5	2.9	0.25
Dark-eyed Junco				4.5	3.0	0.67							1.5	0.0	0.00			
Black-headed Grosbeak	2.9	0.0	0.00	1.5	0.0	0.00				6.0	0.0	0.00	8.9	0.0	0.00			
Lazuli Bunting	16.1	0.0	0.00				17.7	0.0	0.00	23.9	7.5	0.31	6.0	0.0	0.00	22.9	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 2004.

	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-winged Blackbird				4.5	3.0	0.67	1.5	0.0	0.00									
Brown-headed Cowbird	2.9	0.0	0.00	1.5	1.5	1.00	3.0	4.4	1.50	7.5	0.0	0.00	3.0	0.0	0.00	4.3	0.0	0.00
Bullock's Oriole	1.5	0.0	0.00				1.5	13.3	9.00	1.5	3.0	2.00	1.5	1.5	1.00			
Pine Siskin				6.0	1.5	0.25							3.0	0.0	0.00	1.4	0.0	0.00
American Goldfinch	8.8	0.0	0.00				17.7	0.0	0.00	7.5	0.0	0.00	4.5	0.0	0.00			
ALL SPECIES POOLED	124.5	38.1	0.31	107.8	55.4	0.51	167.0	99.0	0.59	245.2	115.1	0.47	261.9	75.9	0.29	171.7	25.8	0.15
Number of Species	24	7		22	15		26	10		27	14		23	12		24	8	
Total Number of Species		25			26			27			28			25			25	

[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 on the Flathead Reservation of the Confederated Salish and Kootenai Tribes MAPS stations combined in 2004.

Species	Birds captured			Birds/600 nethours[1]		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Sharp-shinned Hawk		2				
Ruffed Grouse		2				
Black-chinned Hummingbird		1				
Calliope Hummingbird		49				
Rufous Hummingbird		6				
Unidentified Hummingbird		2				
Lewis's Woodpecker	2			0.5	0.0	0.00
Red-naped Sapsucker	13		17	3.7	0.5	0.13
Downy Woodpecker	12		7	2.5	1.2	0.50
Northern Flicker	4		2	0.7	0.2	0.33
Western Wood-Pewee	9		5	3.0	0.2	0.08
"Traill's" Flycatcher	40	1	37	12.3	0.0	0.00
Least Flycatcher	1			0.2	0.0	0.00
Hammond's Flycatcher	3			0.2	0.2	1.00
Dusky Flycatcher	4		3	1.2	0.0	0.00
"Western" Flycatcher	3			0.7	0.0	0.00
Unident. Empidonax Flycatcher			1			
Eastern Kingbird	6		1	1.5	0.0	0.00
Cassin's Vireo	5		1	1.5	0.0	0.00
Warbling Vireo	9		5	2.2	0.0	0.00
Red-eyed Vireo	10		5	2.7	0.2	0.09
Common Raven		1				
Northern Rough-winged Swallow	2	1		0.7	0.0	0.00
Black-capped Chickadee	118	2	84	13.5	21.1	1.56
Mountain Chickadee	1			0.0	0.2	undf.[1]
Red-breasted Nuthatch	2			0.2	0.2	1.00
House Wren	8	1	4	1.2	0.7	0.60
Marsh Wren	4			0.0	1.0	undf.
Swainson's Thrush	30	1	2	6.9	0.7	0.11
American Robin	32	5	15	9.8	0.2	0.03
Gray Catbird	93	1	61	25.3	3.4	0.14
European Starling	1			0.2	0.0	0.00

Table 4. (cont.) Summary of results for all six on the Flathead Reservation of the Confederated Salish and Kootenai Tribes MAPS stations combined in 2004.

Species	Birds captured			Birds/600 nethours[1]		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Cedar Waxwing	28		4	6.6	0.7	0.11
Orange-crowned Warbler	11			0.7	1.7	2.33
Nashville Warbler	27		1	3.2	3.4	1.08
Yellow Warbler	97	2	73	18.7	9.1	0.49
Yellow-rumped Warbler	1			0.2	0.0	0.00
American Redstart	11		5	2.5	0.2	0.10
Northern Waterthrush	3			0.7	0.0	0.00
MacGillivray's Warbler	6	1	2	1.2	0.2	0.20
Common Yellowthroat	16		6	3.0	0.7	0.25
Wilson's Warbler	1			0.2	0.0	0.00
Yellow-breasted Chat	2			0.5	0.0	0.00
Western Tanager	2			0.5	0.0	0.00
Spotted Towhee	13		6	1.7	2.0	1.14
Chipping Sparrow	17		1	3.2	1.0	0.31
Song Sparrow	82	4	49	12.5	11.6	0.92
Dark-eyed Junco	6	1		1.0	0.5	0.50
Black-headed Grosbeak	9		5	3.2	0.0	0.00
Lazuli Bunting	59	1	24	14.5	1.2	0.08
Red-winged Blackbird	6			1.0	0.5	0.50
Brown-headed Cowbird	17		10	3.7	1.0	0.27
Bullock's Oriole	16			1.0	3.0	3.00
Pine Siskin	8			1.7	0.2	0.14
American Goldfinch	24	1	5	6.4	0.0	0.00
ALL SPECIES POOLED	874	85	441	179.0	67.6	0.38
Total Number of Captures		1400				
Number of Species	47	19	28	45.0	30	
Total Number of Species		53			47	

[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 2003 and 2004 in the numbers of individual ADULT birds captured at six constant-effort MAPS stations on the 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 2003	Number of adults 2004	Percent change	SE[2]	
Lewis's Woodpecker	++++[3]						1	0	2	++++		
Red-naped Sapsucker	133.3	-100.0	0.0	-50.0	-100.0		5	12	13	8.3	39.5	
Downy Woodpecker	-33.3	-100.0	-40.0	-50.0	50.0	0.0	6	15	10	-33.3	16.1	*
Hairy Woodpecker		-100.0		-100.0			2	2	0	-100.0	88.9	
Northern Flicker	-66.7		-100.0	-66.7	-100.0		4	13	3	-76.9	8.9	***
Western Wood-Pewee	-40.0	0.0	-81.3	-100.0	-50.0	33.3	6	28	12	-57.1	19.0	**
"Traill's" Flycatcher	33.3	-33.3	133.3	-30.8	-88.9	75.0	6	54	48	-11.1	26.1	
Least Flycatcher	0.0	-100.0	-100.0	-100.0	-100.0		5	6	1	-83.3	17.6	***
Hammond's Flycatcher			++++[3]				1	0	1	++++[3]		
Dusky Flycatcher		-80.0	0.0		++++[3]	100.0	4	7	5	-28.6	50.4	
"Western" Flycatcher				0.0		-50.0	2	5	3	-40.0	16.0	
Eastern Kingbird	-100.0		0.0	++++[3]		++++[3]	4	2	6	200.0	316.2	
Cassin's Vireo		100.0		100.0			2	3	6	100.0	88.9	
Warbling Vireo	-100.0		100.0	0.0		++++	4	6	9	50.0	131.2	
Red-eyed Vireo	-50.0			0.0	-11.1	++++	4	12	11	-8.3	12.8	
Tree Swallow			-100.0				1	1	0	-100.0		
N. Rough-winged Swallow			++++			-33.3	2	3	3	0.0	66.7	
Black-capped Chickadee	-37.5	0.0	-12.5	8.3	33.3	0.0	6	50	51	2.0	11.2	
Mountain Chickadee		-100.0					1	1	0	-100.0		
Red-breasted Nuthatch	++++	-100.0					2	1	1	0.0	200.0	
Pygmy Nuthatch		-100.0					1	1	0	-100.0		
Brown Creeper							0	0	0			
House Wren	++++	++++[3]				-50.0	3	6	5	-16.7	50.0	
Marsh Wren							0	0	0			
Golden-crowned Kinglet		-100.0					1	1	0	-100.0		

Table 5. (cont.) Percentage changes between 2003 and 2004 in the numbers of individual ADULT birds captured at six constant-effort MAPS stations on the 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 2003	All six stations combined: Number of adults 2004	All six stations combined: Percent change	All six stations combined: SE[2]	
Veery					-100.0		1	1	0	-100.0		
Swainson's Thrush		0.0	100.0	40.0	-26.3	50.0	5	29	28	-3.4	19.6	
American Robin	-56.0	100.0	-65.0	-100.0	-40.0	0.0	6	62	35	-43.5	14.7	**
Gray Catbird	-25.0	-66.7	-14.3	11.1	-15.3	-13.0	6	114	100	-12.3	4.7	**
European Starling			++++				1	0	1	++++		
Cedar Waxwing	0.0	-25.0	-100.0	-50.0	-42.9	400.0	6	40	27	-32.5	17.2	
Orange-crowned Warbler		++++		-100.0	-100.0	++++	4	3	3	0.0	121.7	
Nashville Warbler	++++			++++	900.0		3	1	13	1200.0	458.3	
Yellow Warbler	-12.5	-100.0	8.3	-10.7	-8.7	-16.7	6	85	76	-10.6	3.9	**
Yellow-rumped Warbler		++++					1	0	1	++++		
Townsend's Warbler							0	0	0			
American Redstart	++++			-60.0	++++		3	5	10	100.0	261.5	
Northern Waterthrush			++++				1	0	3	++++		
MacGillivray's Warbler		0.0	100.0	0.0	-100.0	-100.0	5	8	5	-37.5	35.6	
Common Yellowthroat		-66.7	++++	-20.0		400.0	4	9	12	33.3	74.3	
Wilson's Warbler				++++		-100.0	2	1	1	0.0	200.0	
Yellow-breasted Chat			++++	-50.0	-100.0		3	4	2	-50.0	43.3	
Western Tanager		-100.0	++++	++++	-100.0		4	3	2	-33.3	79.1	
Spotted Towhee		-50.0			-25.0	-66.7	3	13	7	-46.2	10.1	**
Chipping Sparrow	++++	++++			++++	300.0	4	1	13	1200.0	1275.4	
Song Sparrow	-40.0	166.7	-22.2	-42.9	0.0	0.0	6	57	49	-14.0	16.3	
Dark-eyed Junco		50.0			++++		2	2	4	100.0	100.0	
Black-headed Grosbeak	++++	-66.7		++++	-45.5		4	14	12	-14.3	43.0	
Lazuli Bunting	++++		175.0	150.0	300.0	128.6	5	18	57	216.7	83.0	*
Red-winged Blackbird		50.0	0.0				2	3	4	33.3	22.2	

Table 5. (cont.) Percentage changes between 2003 and 2004 in the numbers of individual ADULT birds captured at six constant-effort MAPS stations on the 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 2003	Number of adults 2004	Percent change	SE[2]
Western Meadowlark	-100.0						1	1	0	-100.0	
Brewer's Blackbird			-100.0				1	2	0	-100.0	
Brown-headed Cowbird	++++	-83.3	-75.0	0.0	0.0	++++	6	21	15	-28.6	33.0
Bullock's Oriole	++++		0.0	++++	++++	-100.0	5	2	4	100.0	158.1
House Finch		-100.0	-100.0				2	2	0	-100.0	88.9
Pine Siskin		300.0			++++	++++	3	1	7	600.0	458.3
American Goldfinch	++++		-29.4	200.0	-33.3	-100.0	5	22	23	4.5	44.2
ALL SPECIES POOLED	1.3	-15.5	-19.7	-5.5	-11.2	22.6	6	753	704	-6.5	5.1
No. species that increased[4]	13(11)	10(4)	13(7)	12(6)	10(6)	14(6)				20(5)	
No. species that decreased[5]	12(3)	19(11)	14(6)	15(5)	19(8)	10(4)				30(9)	
No. species remained same	2	4	5	5	2	4				4	
Total Number of Species	27	33	32	32	31	28				54	
Proportion of increasing (decreasing) species	0.481	(0.576)	(0.438)	(0.469)	(0.613)	0.500				(0.556)	
Sig. of increase (decrease)[6]	0.649	(0.243)	(0.811)	(0.702)	(0.141)	0.575				(0.248)	

[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 2003.
[4] No. of species for which adults were captured in 2004 but not in 2003 are in parentheses.
[5] No. of species for which adults were captured in 2003 but not in 2004 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 2003 and 2004 in the numbers of individual YOUNG birds captured at six constant-effort MAPS stations on the 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: n[1]	Number of young: 2003	Number of young: 2004	Percent change	SE[2]	
Lewis's Woodpecker							0	0	0			
Red-naped Sapsucker			-66.7	0.0			2	4	2	-50.0	25.0	
Downy Woodpecker			0.0	100.0	0.0	-100.0	4	5	5	0.0	32.7	
Hairy Woodpecker							0	0	0			
Northern Flicker	-100.0		-100.0	0.0	-100.0		4	6	1	-83.3	19.2	**
Western Wood-Pewee	++++[3]						1	0	1	++++[3]		
"Traill's" Flycatcher							0	0	0			
Least Flycatcher			-100.0				1	2	0	-100.0		
Hammond's Flycatcher			++++[3]				1	0	1	++++		
Dusky Flycatcher		-100.0					1	1	0	-100.0		
"Western" Flycatcher						-100.0	1	1	0	-100.0		
Eastern Kingbird							0	0	0			
Cassin's Vireo							0	0	0			
Warbling Vireo							0	0	0			
Red-eyed Vireo					++++[3]		1	0	1	++++		
Tree Swallow							0	0	0			
Northern Rough-winged Swallow							0	0	0			
Black-capped Chickadee	33.3	-63.2	100.0	-16.7	-15.8	33.3	6	89	85	-4.5	19.5	
Mountain Chickadee		-66.7					1	3	1	-66.7		
Red-breasted Nuthatch					++++	-100.0	2	2	1	-50.0	100.0	
Pygmy Nuthatch		-100.0					1	4	0	-100.0		
Brown Creeper		-100.0					1	1	0	-100.0		
House Wren		-100.0	++++	-100.0	-100.0	-50.0	5	7	3	-57.1	20.4	**
Marsh Wren		++++[3]					1	0	4	++++		
Golden-crowned Kinglet			-100.0				1	1	0	-100.0		

Table 6. (cont.) Percentage changes between 2003 and 2004 in the numbers of individual YOUNG birds captured at six constant-effort MAPS stations on the 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 2003	All six stations combined: Number of young 2004	All six stations combined: Percent change	All six stations combined: SE[2]	
Veery							0	0	0			
Swainson's Thrush		-100.0		0.0	0.0		3	4	3	-25.0	28.6	
American Robin	-100.0		-100.0	-100.0	-100.0	0.0	5	20	1	-95.0	6.1	***
Gray Catbird			0.0	400.0	-66.7	0.0	4	24	14	-41.7	33.1	
European Starling							0	0	0			
Cedar Waxwing		++++			-100.0		2	2	3	50.0	300.0	
Orange-crowned Warbler	++++	++++		++++[3]	++++	-100.0	5	1	7	600.0	894.4	
Nashville Warbler	++++	++++	-100.0	++++	0.0	++++[3]	6	2	14	600.0	751.0	
Yellow Warbler	300.0	++++	-72.7	0.0	-53.8	-71.4	6	85	37	-56.5	14.2	**
Yellow-rumped Warbler							0	0	0			
Townsend's Warbler			-100.0				1	1	0	-100.0		
American Redstart				++++			1	0	1	++++		
Northern Waterthrush					-100.0		1	1	0	-100.0		
MacGillivray's Warbler			-100.0	0.0	-100.0		3	5	1	-80.0	24.0	*
Common Yellowthroat		50.0			-100.0		2	3	3	0.0	66.7	
Wilson's Warbler							0	0	0			
Yellow-breasted Chat							0	0	0			
Western Tanager			-100.0		-100.0		2	3	0	-100.0	88.9	
Spotted Towhee		0.0		-100.0	-30.0		3	12	8	-33.3	8.3	*
Chipping Sparrow	++++	++++				++++	3	0	4	++++		
Song Sparrow	-33.3	50.0	-12.5	27.3	-70.0	-50.0	6	58	44	-24.1	21.5	
Dark-eyed Junco		++++					1	0	2	++++		
Black-headed Grosbeak			-100.0		-100.0		2	4	0	-100.0	88.9	
Lazuli Bunting			-100.0	++++			2	2	5	150.0	500.0	
Red-winged Blackbird		++++					1	0	2	++++		

Table 6. (cont.) Percentage changes between 2003 and 2004 in the numbers of individual YOUNG birds captured at six constant-effort MAPS stations on the 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 2003	All six stations combined: Number of young 2004	All six stations combined: Percent change	All six stations combined: SE[2]
Western Meadowlark							0	0	0		
Brewer's Blackbird							0	0	0		
Brown-headed Cowbird	-100.0	++++	++++		-100.0		4	2	4	100.0	244.9
Bullock's Oriole			350.0	++++	++++		3	2	12	500.0	229.1
House Finch		-100.0	-100.0				2	4	0	-100.0	88.9
Pine Siskin	-100.0	0.0					2	2	1	-50.0	50.0
American Goldfinch							0	0	0		
ALL SPECIES POOLED	-3.7	-10.0	-38.7	41.5	-53.2	-35.7	6	363	271	-25.3	15.0
No. species that increased[4]	6(4)	11(9)	5(3)	8(5)	4(4)	3(2)				14(8)	
No. species that decreased[5]	5(4)	8(6)	14(11)	4(3)	15(10)	7(4)				25(11)	
No. species remained same	0	2	2	5	3	2				2	
Total Number of Species	11	21	21	17	22	12				41	
Proportion of increasing (decreasing) species	(0.455)	(0.381)	(0.667)	0.471	(0.682)	(0.583)				(0.610)	
Sig. of increase (decrease)[6]	(0.726)	(0.905)	(0.095) *	0.685	(0.067)	(0.387)				(0.106)	

[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 2003.
[4] No. of species for which young birds were captured in 2004 but not in 2003 are in parentheses.
[5] No. of species for which young birds were captured in 2003 but not in 2004 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. Absolute changes between 2003 and 2004 in the REPRODUCTIVE INDEX (young/adult) at six constant-effort MAPS stations on the 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 2003	All six stations combined: Reproductive Index 2004	All six stations combined: Change	All six stations combined: SE[2]	
Lewis's Woodpecker	+-+-+[3]						1	undf.[4]	0.000	+-+-+[3]		
Red-naped Sapsucker	0.000	+-+-+[3]	-0.400	0.500	+-+-+[3]		5	0.333	0.154	-0.180	0.203	
Downy Woodpecker	0.000	+-+-+	0.267	1.500	-0.167	-1.000	6	0.333	0.500	0.167	0.245	
Hairy Woodpecker		+-+-+		+-+-+[3]			2	0.000	undf.[4]	+-+-+		
Northern Flicker	-0.167		+-+-+[3]	0.667	+-+-+		4	0.462	0.333	-0.128	0.425	
Western Wood-Pewee	0.333	0.000	0.000	+-+-+	0.000	0.000	6	0.000	0.083	0.083	0.079	
"Traill's" Flycatcher	0.000	0.000	0.000	0.000	0.000	0.000	6	0.000	0.000			
Least Flycatcher	0.000	+-+-+	+-+-+	+-+-+	+-+-+		5	0.333	0.000	-0.333	0.278	
Hammond's Flycatcher			+-+-+				1	undf.	1.000	+-+-+		
Dusky Flycatcher		-0.200	0.000		+-+-+	0.000	4	0.143	0.000	-0.143	0.058	*
"Western" Flycatcher				0.000		-0.250	2	0.200	0.000	-0.200	0.080	
Eastern Kingbird	+-+-+		0.000	+-+-+		+-+-+[3]	4	0.000	0.000			
Cassin's Vireo		0.000		0.000			2	0.000	0.000			
Warbling Vireo	+-+-+		0.000	0.000		+-+-+	4	0.000	0.000			
Red-eyed Vireo	0.000			0.000	0.125	+-+-+	4	0.000	0.091	0.091	0.033	*
Tree Swallow			+-+-+				1	0.000	undf.	+-+-+		
N. Rough-winged Swallow			+-+-+			0.000	2	0.000	0.000			
Black-capped Chickadee	1.700	-2.400	1.446	-0.462	-0.583	0.400	6	1.780	1.667	-0.113	0.418	
Mountain Chickadee		+-+-+					1	3.000	undf.	+-+-+		
Red-breasted Nuthatch	+-+-+	+-+-+			+-+-+	+-+-+	4	2.000	1.000	-1.000	3.651	
Pygmy Nuthatch		+-+-+					1	4.000	undf.	+-+-+		
Brown Creeper		+-+-+					1	undf.	undf.	+-+-+		
House Wren	+-+-+	+-+-+	+-+-+	+-+-+	+-+-+	0.000	6	1.167	0.600	-0.567	0.696	
Marsh Wren		+-+-+					1	undf.	undf.	+-+-+		
Golden-crowned Kinglet		+-+-+	+-+-+				2	1.000	undf.	+-+-+		

Table 7. (cont.) Absolute changes between 2003 and 2004 in the REPRODUCTIVE INDEX (young/adult) at six constant-effort MAPS stations on the 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 2003	2004	Change	SE[2]	
Veery					+-+-+		1	0.000	undf.	+-+-+		
Swainson's Thrush		-0.500	0.000	-0.057	0.038	0.000	5	0.138	0.107	-0.031	0.049	
American Robin	-0.320	0.000	-0.200	+-+-+	-1.200	0.000	6	0.323	0.029	-0.294	0.098	**
Gray Catbird	0.000	0.000	0.024	0.194	-0.216	0.007	6	0.211	0.140	-0.071	0.100	
European Starling			+-+-+				1	undf.	0.000	+-+-+		
Cedar Waxwing	0.000	0.250	+-+-+	0.000	-0.286	0.000	6	0.050	0.111	0.061	0.092	
Orange-crowned Warbler	+-+-+	+-+-+		+-+-+	+-+-+	+-+-+	5	0.333	2.333	2.000	2.187	
Nashville Warbler	+-+-+	+-+-+	+-+-+	+-+-+	-0.900	+-+-+	6	2.000	1.077	-0.923	1.879	
Yellow Warbler	0.446	+-+-+	-3.430	0.039	-0.280	-0.383	6	1.000	0.487	-0.513	0.648	
Yellow-rumped Warbler		+-+-+					1	undf.	0.000	+-+-+		
Townsend's Warbler			+-+-+				1	undf.	undf.	+-+-+		
American Redstart	+-+-+			0.500	+-+-+		3	0.000	0.100	0.100	0.131	
Northern Waterthrush			+-+-+		+-+-+		2	undf.	0.000	+-+-+		
MacGillivray's Warbler		0.000	-2.000	0.000	+-+-+	+-+-+	5	0.625	0.200	-0.425	0.286	
Common Yellowthroat		2.333	+-+-+	0.000	+-+-+	0.000	5	0.333	0.250	-0.083	0.407	
Wilson's Warbler				+-+-+		+-+-+	2	0.000	0.000			
Yellow-breasted Chat			+-+-+	0.000	+-+-+		3	0.000	0.000			
Western Tanager		+-+-+	+-+-+	+-+-+	+-+-+		4	1.000	0.000	-1.000	0.943	
Spotted Towhee		0.167		+-+-+	-0.167	0.000	4	0.923	1.143	0.220	1.043	
Chipping Sparrow	+-+-+	+-+-+			+-+-+	0.250	4	0.000	0.308	0.308	0.050	***
Song Sparrow	0.067	-0.583	0.222	0.643	-1.077	-0.333	6	1.018	0.898	-0.120	0.368	
Dark-eyed Junco		0.667			+-+-+		2	0.000	0.500	0.500	0.250	
Black-headed Grosbeak	+-+-+	0.000	+-+-+	+-+-+	-0.273		5	0.286	0.000	-0.286	0.106	*
Lazuli Bunting	+-+-+		-0.500	0.333	0.000	0.000	5	0.111	0.088	-0.023	0.142	
Red-winged Blackbird		0.667	0.000				2	0.000	0.500	0.500	0.250	

Table 7. (cont.) Absolute changes between 2003 and 2004 in the REPRODUCTIVE INDEX (young/adult) at six constant-effort MAPS stations on the 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 2003	Reproductive Index 2004	Change	SE[2]
Western Meadowlark	+-+-+						1	0.000	undf.	+-+-+	
Brewer's Blackbird			+-+-+				1	0.000	undf.	+-+-+	
Brown-headed Cowbird	+-+-+	1.000	1.500	0.000	-0.500	+-+-+	6	0.095	0.267	0.171	0.243
Bullock's Oriole	+-+-+		7.000	+-+-+	+-+-+	+-+-+	5	1.000	3.000	2.000	2.129
House Finch		+-+-+	+-+-+				2	2.000	undf.	+-+-+	
Pine Siskin	+-+-+	-0.750			+-+-+	+-+-+	4	2.000	0.143	-1.857	1.635
American Goldfinch	+-+-+		0.000	0.000	0.000	+-+-+	5	0.000	0.000		
ALL SPECIES POOLED	-0.017	0.031	-0.183	0.162	-0.263	-0.143	6	0.482	0.385	-0.097	0.102
No. species that increased	4	6	6	8	2	3				12	
No. species that decreased	2	5	5	2	11	4				20	
No. species remained same	7	7	8	11	4	11				9	
Total Number of Species[5]	13	18	19	21	17	18				41	
Proportion of increasing (decreasing) species	(0.154)	0.333	(0.263)	0.381	(0.647)	(0.222)				(0.488)	
Sig. of increase (decrease)[6]	(0.998)	0.952	(0.990)	0.905	(0.166)	(0.996)				(0.622)	

[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.
*** $P < 0.01$; ** $0.01 \le P < 0.05$; * $0.05 \le P < 0.10$

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 12 years, 1993-2004. Data for each species are included only from stations that lie within the breeding range of the species.

	Safe Harbor Marsh			Crow Creek			Both stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
American Kestrel				0.2	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	0.6	0.0	0.00	1.1	0.1	0.13	0.8	0.1	0.04
Hairy Woodpecker	0.1	0.0	0.00	0.0	0.2	undf.[2]	0.1	0.1	0.00
Northern Flicker	0.1	0.0	0.00	0.3	0.2	0.00	0.2	0.1	0.00
Western Wood-Pewee	1.2	0.2	0.14	3.2	0.1	0.02	2.2	0.1	0.06
"Traill's" Flycatcher	5.8	0.2	0.08	7.8	0.3	0.04	6.8	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	0.7	0.0	0.00	1.0	0.0	0.00
Dusky Flycatcher	3.1	0.5	0.09	0.8	0.0	0.00	2.0	0.3	0.07
"Western" Flycatcher	0.4	0.0	0.00	1.4	0.3	0.25	0.9	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	1.0	0.0	0.00	0.6	0.0	0.00
Cassin's Vireo	1.0	0.0	0.00	0.3	0.1	0.00	0.6	0.1	0.10
Warbling Vireo	2.8	0.0	0.00	0.9	0.0	0.00	1.8	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				0.3	0.0	0.00
N. Rough-winged Swallow				2.0	0.3	0.25	1.0	0.2	0.25
Bank Swallow				0.6	0.0	0.00	0.3	0.0	0.00
Black-capped Chickadee	6.6	14.2	2.88	16.2	12.5	0.98	11.4	13.4	1.36
Mountain Chickadee	0.7	1.6	1.50				0.3	0.8	1.50
Red-breasted Nuthatch	2.9	1.2	0.36	1.6	0.9	0.56	2.3	1.0	0.59
Pygmy Nuthatch	0.6	0.6	1.00				0.3	0.3	1.00
Brown Creeper	0.0	0.1	undf.[2]				0.0	0.1	undf.[2]
House Wren	0.2	0.3	0.00	10.4	4.1	0.45	5.3	2.2	0.47
Marsh Wren	1.0	4.3	3.10				0.5	2.2	3.10
Golden-crowned Kinglet	0.1	0.2	0.00	0.0	0.2	undf.	0.1	0.2	0.00
Townsend's Solitaire	0.1	0.1	0.00				0.1	0.1	0.00
Swainson's Thrush	5.7	0.9	0.18	3.1	0.3	0.03	4.4	0.6	0.14
American Robin	10.1	1.0	0.13	5.7	0.7	0.12	7.9	0.9	0.14
Gray Catbird	1.4	0.0	0.00	16.0	1.1	0.08	8.7	0.6	0.07
Cedar Waxwing	25.6	0.5	0.03	4.2	0.4	0.15	14.9	0.5	0.05
Tennessee Warbler	0.2	0.0	0.00				0.1	0.0	0.00
Orange-crowned Warbler	1.4	0.5	0.10	0.9	0.3	0.00	1.1	0.4	0.06
Nashville Warbler	0.2	0.1	0.00	0.0	0.3	undf.	0.1	0.2	0.00
Yellow Warbler	1.2	0.1	0.00	13.9	2.7	0.19	7.5	1.4	0.18
Yellow-rumped Warbler	0.3	0.2	0.00	0.0	0.2	undf.	0.1	0.2	0.00
Townsend's Warbler	0.0	0.2	undf.	0.3	0.0	0.00	0.2	0.1	0.50

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 12 years, 1993-2004. Data for each species are included only from stations that lie within the breeding range of the species.

	Safe Harbor Marsh			Crow Creek			Both stations pooled		
Species	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]	Ad.	Yg.	Repr. Ind.[1]
Northern Waterthrush	0.0	0.1	undf.	0.2	0.0	0.00	0.1	0.1	0.00
MacGillivray's Warbler	2.1	0.3	0.05	0.9	0.0	0.00	1.5	0.2	0.13
Common Yellowthroat	14.0	5.6	0.64	1.7	0.2	0.06	7.9	2.9	0.39
Wilson's Warbler	0.1	0.0	0.00	0.5	0.0	0.00	0.3	0.0	0.00
Western Tanager	3.1	0.3	0.09				1.6	0.2	0.09
Spotted Towhee	2.2	1.6	0.25	2.2	0.8	0.39	2.2	1.2	0.58
Chipping Sparrow	3.8	0.7	0.14	3.3	0.7	0.28	3.5	0.7	0.20
Vesper Sparrow	0.3	0.0	0.00	0.2	0.0	0.00	0.2	0.0	0.00
Song Sparrow	9.9	6.6	0.82	7.8	3.3	0.60	8.8	4.9	0.66
Dark-eyed Junco	2.5	2.7	1.30	0.0	0.2	undf.	1.3	1.4	1.41
Black-headed Grosbeak	0.6	0.0	0.00	0.7	0.0	0.00	0.7	0.0	0.00
Lazuli Bunting				9.0	0.2	0.02	4.5	0.1	0.02
Red-winged Blackbird	2.1	0.4	0.19				1.0	0.2	0.19
Yellow-headed Blackbird	0.3	0.0	0.00				0.1	0.0	0.00
Brown-headed Cowbird	3.6	0.5	0.10	1.3	0.2	0.17	2.5	0.3	0.21
Bullock's Oriole				1.2	0.6	0.25	0.6	0.3	0.25
Cassin's Finch	1.1	0.0	0.00				0.6	0.0	0.00
House Finch	0.1	0.2	2.00				0.1	0.1	2.00
Red Crossbill	0.6	0.5	0.50				0.3	0.2	0.50
Pine Siskin	7.2	0.7	0.21	0.4	0.0	0.00	3.8	0.3	0.20
American Goldfinch				0.7	0.0	0.00	0.3	0.0	0.00
Evening Grosbeak	0.4	0.0	0.00				0.2	0.0	0.00
ALL SPECIES POOLED	129.9	46.9	0.37	122.9	31.4	0.25	126.6	39.1	0.31
Number of Species	50	33		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 Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the two years, 2003 and 2004. Data for each species are included only from stations that lie within the breeding range of the species.

	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	1.5	0.0	0.00																0.2	0.0	0.00
Red-naped Sapsucker	8.1	0.0	0.00	0.7	0.0	0.00	7.4	2.9	0.40	3.1	1.5	0.50	0.7	0.0	0.00				3.3	0.7	0.23
Downy Woodpecker	3.7	0.0	0.00	1.5	0.0	0.00	5.9	2.9	0.53	2.3	2.3	1.25	3.7	1.5	0.42	1.5	0.7	0.50	3.1	1.2	0.42
Hairy Woodpecker				0.7	0.0	0.00				0.8	0.0	0.00							0.2	0.0	0.00
Northern Flicker	5.9	0.7	0.08				0.7	0.7	1.00	3.1	1.5	0.67	2.2	2.2	1.00				2.0	0.9	0.40
Western Wood-Pewee	6.7	0.7	0.17	1.5	0.0	0.00	14.7	0.0	0.00	0.8	0.0	0.00	2.2	0.0	0.00	5.1	0.0	0.00	5.2	0.1	0.04
"Traill's" Flycatcher	5.2	0.0	0.00	8.2	0.0	0.00	14.8	0.0	0.00	36.1	0.0	0.00	7.4	0.0	0.00	8.7	0.0	0.00	13.2	0.0	0.00
Least Flycatcher	1.5	0.0	0.00	0.7	0.0	0.00	1.5	1.5	1.00	0.8	0.0	0.00	0.7	0.0	0.00				0.9	0.2	0.17
Hammond's Flycatcher							0.7	0.7	1.00										0.1	0.1	1.00
Dusky Flycatcher				4.4	0.7	0.10	1.5	0.0	0.00				0.7	0.0	0.00	2.2	0.0	0.00	1.5	0.1	0.07
"Western" Flycatcher										1.5	0.0	0.00				4.4	0.7	0.13	1.0	0.1	0.10
Eastern Kingbird	0.7	0.0	0.00				1.5	0.0	0.00	3.0	0.0	0.00				0.7	0.0	0.00	1.0	0.0	0.00
Cassin's Vireo				2.2	0.0	0.00				4.6	0.0	0.00							1.1	0.0	0.00
Warbling Vireo	2.2	0.0	0.00				2.9	0.0	0.00	3.1	0.0	0.00				3.6	0.0	0.00	2.0	0.0	0.00
Red-eyed Vireo	2.2	0.0	0.00							1.5	0.0	0.00	14.1	0.7	0.06	0.7	0.0	0.00	3.1	0.1	0.05
Tree Swallow							0.7	0.0	0.00										0.1	0.0	0.00
N. Rough-winged Swal.							0.7	0.0	0.00							3.6	0.0	0.00	0.7	0.0	0.00
Black-capped Chickadee	11.8	21.4	1.98	7.4	19.3	2.60	11.8	19.9	1.79	23.7	36.8	1.55	20.8	29.0	1.46	7.3	10.1	1.40	13.7	22.6	1.65
Mountain Chickadee				0.7	3.0	3.00													0.1	0.5	3.00
Red-breasted Nuthatch	0.7	0.0	0.00	0.7	0.0	0.00							0.0	0.7	und.[3]	0.0	1.5	und.[3]	0.2	0.4	1.50
Pygmy Nuthatch				0.7	3.0	4.00													0.1	0.5	4.00
Brown Creeper				0.0	0.7	und.[3]													0.0	0.1	und.[3]
House Wren	0.7	0.0	0.00	0.7	0.7	0.00	0.0	0.7	und.[3]	0.0	0.8	und.[3]	0.0	0.7	und.	6.6	4.4	0.67	1.4	1.2	0.88
Marsh Wren				0.0	3.0	und.													0.0	0.5	und.
Golden-crowned Kinglet				0.7	0.0	0.00	0.0	0.7	und.										0.1	0.1	1.00
Veery													0.7	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 Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the two years, 2003 and 2004. Data for each species are included only from stations that lie within the breeding range of the species.

Species	Woodpecker Haven			Safe Harbor Marsh			Schall			Spring Creek			Jocko River			Crow Creek			All stations pooled		
	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]
Swainson's Thrush				3.0	0.7	0.25	2.2	0.0	0.00	9.1	1.5	0.17	24.6	3.0	0.12	3.6	0.0	0.00	7.1	0.9	0.12
American Robin	31.1	6.0	0.14	10.4	0.0	0.00	24.3	3.7	0.10	2.3	0.8	0.33	6.7	4.5	0.60	9.4	1.5	0.15	14.1	2.7	0.15
Gray Catbird	5.2	0.0	0.00	3.0	0.0	0.00	9.6	1.5	0.15	30.5	4.5	0.15	81.9	20.9	0.25	32.7	1.5	0.04	27.1	4.7	0.17
European Starling							0.7	0.0	0.00										0.1	0.0	0.00
Cedar Waxwing	3.0	0.0	0.00	20.8	2.2	0.13	4.4	0.0	0.00	10.0	0.0	0.00	8.2	1.5	0.14	4.3	0.0	0.00	8.4	0.6	0.08
Orange-crowned Warbler	0.0	0.7		1.5	0.7	0.50				0.8	2.2	0.00	1.5	1.5	0.00	0.7	0.7	0.00	0.7	1.0	1.33
Nashville Warbler	0.7	0.7	1.00	0.0	0.7	und.	0.0	0.7	und.	1.5	7.5	5.00	8.2	1.5	0.55	0.0	0.7	und.	1.7	2.0	1.54
Yellow Warbler	11.1	5.2	0.47	1.5	0.7	0.00	19.9	51.5	2.65	41.4	13.8	0.34	33.5	14.1	0.41	16.0	6.6	0.39	20.4	15.4	0.73
Yellow-rumped Warbler				0.7	0.0	0.00													0.1	0.0	0.00
Townsend's Warbler							0.0	0.7	und.										0.0	0.1	und.
American Redstart	0.7	0.0	0.00							5.4	0.7	0.25	5.2	0.0	0.00				1.9	0.1	0.05
Northern Waterthrush							2.2	0.0	0.00				0.0	0.7	und.				0.4	0.1	0.00
MacGillivray's Warbler				1.5	0.0	0.00	3.0	1.5	1.00	3.1	1.5	0.50	2.2	1.5	0.67	0.7	0.0	0.00	1.7	0.7	0.40
Common Yellowthroat				3.0	3.7	1.83	1.5	0.0	0.00	6.9	0.0	0.00	0.0	0.7	und.	4.3	0.0	0.00	2.6	0.7	0.29
Wilson's Warbler										0.7	0.0	0.00				0.7	0.0	0.00	0.2	0.0	0.00
Yellow-breasted Chat							0.7	0.0	0.00	2.3	0.0	0.00	2.2	0.0	0.00				0.9	0.0	0.00
Western Tanager				1.5	0.0	0.00	0.7	0.7	0.00	0.7	0.0	0.00	0.7	1.5	2.00				0.6	0.4	0.50
Spotted Towhee				6.7	1.5	0.25				0.0	0.8	und.	5.2	12.7	2.42	2.9	0.0	0.00	2.5	2.5	1.03
Chipping Sparrow	1.5	0.7	0.50	4.5	1.5	0.33							0.7	0.0	0.00	3.6	0.7	0.13	1.7	0.5	0.15
Song Sparrow	5.9	3.7	0.63	8.2	8.2	1.10	12.5	23.6	1.94	25.4	19.8	0.87	19.4	19.4	1.00	10.1	4.4	0.46	13.5	13.1	0.97
Lincoln's Sparrow	0.0	0.7	und.[3]																0.0	0.1	und.
Dark-eyed Junco				3.7	1.5	0.33							0.7	0.0	0.00				0.7	0.2	0.25
Black-headed Grosbeak	1.5	0.0	0.00	3.0	0.0	0.00	0.0	0.7	und.	3.0	0.0	0.00	13.4	2.2	0.13				3.5	0.5	0.13
Lazuli Bunting	8.1	0.0	0.00				12.5	1.5	0.20	16.6	3.7	0.16	3.7	0.0	0.00	16.6	0.0	0.00	9.6	0.9	0.10
Red-winged Blackbird				4.5	1.5	0.33	1.5	0.0	0.00										1.0	0.2	0.25
Western Meadowlark	0.7	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 Flathead Reservation of the Confederated Salish and Kootenai Tribes averaged over the two years, 2003 and 2004. Data for each species are included only from stations that lie within the breeding range of the species.

	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]
Brewer's Blackbird							1.5	0.0	0.00										0.2	0.0	0.00
Brown-headed Cowbird	1.5	0.7	0.00	5.2	0.7	0.50	7.4	2.2	0.75	8.4	0.0	0.00	3.0	0.7	0.25	2.1	0.0	0.00	4.6	0.7	0.18
Bullock's Oriole	0.7	0.0	0.00				1.5	8.1	5.50	0.7	1.5	2.00	0.7	0.7	1.00	0.7	0.0	0.00	0.7	1.7	2.00
House Finch				0.7	1.5	2.00	0.7	1.5	2.00										0.2	0.5	2.00
Red Crossbill				0.7	0.0	0.00													0.1	0.0	0.00
Pine Siskin	0.0	0.7	und.	3.7	1.5	0.63							1.5	0.0	0.00	0.7	0.0	0.00	1.0	0.4	1.07
American Goldfinch	4.4	0.0	0.00				21.4	0.0	0.00	5.3	0.0	0.00	6.0	0.0	0.00	0.7	0.0	0.00	6.3	0.0	0.00
ALL SPECIES POOLED	127.0	42.1	0.33	119.0	57.3	0.48	193.0	128.1	0.66	258.6	101.3	0.40	282.9	122.1	0.42	154.2	33.5	0.23	188.6	80.6	0.42
Number of Species	27	12		34	21		32	21		32	17		31	22		28	12		55	42	
Total Number of Species		30			37			37			34			35			30			59	

[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] For numbers presented in italics, the mean number of adults or young is greater than 0.1 at one or more stations, but over the entire location the mean number is less than 0.05. The species is counted in the number of species over all stations pooled.
[3] 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 12 years (1993-2004) of mark-recapture data from two (Safe Harbor Marsh and Crow Creek) MAPS stations 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	$\phi p \tau$ [3]	$\phi_t p \tau$ [4]	$\phi p_t \tau$ [5]	$\phi p \tau_t$ [6]	$\phi_t p_t \tau$ [7]	$\phi_t p \tau_t$ [8]	$\phi p_t \tau_t$ [9]	$\phi_t p_t \tau_t$ [10]	$\Delta QAIC_C$
Western Wood-Pewee	38.52* (1.000)	71.79 (1.000)	73.68 (1.000)	79.76 (1.000)	259.40 (1.000)	340.00 (1.000)	340.70 (1.000)	undf. (1.000)	33.27
"Traill's" Flycatcher	37.52* (1.000)	52.48 (1.000)	56.62 (1.000)	56.23 (1.000)	80.60 (1.000)	81.38 (1.000)	84.99 (1.000)	115.30 (1.000)	14.96
Black-capped Chickadee	115.00* (1.000)	119.60 (1.000)	123.60 (1.000)	127.10 (1.000)	129.60 (1.000)	140.60 (1.000)	140.40 (1.000)	150.70 (1.000)	4.60
House Wren	36.30* (1.000)	50.31 (1.000)	47.78 (1.000)	56.10 (1.000)	77.13 (1.000)	85.74 (1.000)	83.39 (1.000)	123.20 (1.000)	14.01
Swainson's Thrush	46.04* (1.000)	65.16 (1.000)	67.22 (1.000)	72.09 (1.000)	136.10 (1.000)	150.90 (1.000)	150.40 (1.000)	473.90 (1.000)	19.12
American Robin	65.49* (1.000)	78.43 (1.000)	79.12 (1.000)	78.07 (1.000)	98.91 (1.000)	99.24 (1.000)	98.25 (1.000)	123.10 (1.000)	12.94
Gray Catbird	64.64* (1.000)	76.60 (1.000)	73.19 (1.000)	74.20 (1.000)	90.83 (1.000)	94.50 (1.000)	92.80 (1.000)	116.60 (1.000)	11.96
Yellow Warbler	82.29* (1.000)	85.72 (1.000)	92.81 (1.000)	95.73 (1.000)	108.40 (1.000)	112.20 (1.000)	114.10 (1.000)	141.10 (1.000)	3.43
Common Yellowthroat	88.89* (1.000)	105.40 (1.000)	107.50 (1.000)	104.40 (1.000)	130.10 (1.000)	128.00 (1.000)	129.60 (1.000)	157.90 (1.000)	16.51

Table 10. (cont.) Summary statistics for survival analyses with temporally variable survival and recapture probabilities and proportion of residents in transient models using 12 years (1993-2004) of mark-recapture data from two (Safe Harbor Marsh and Crow Creek) MAPS stations 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	$\phi p \tau$ [3]	$\phi_t p \tau$ [4]	$\phi p_t \tau$ [5]	$\phi p \tau_t$ [6]	$\phi_t p_t \tau$ [7]	$\phi_t p \tau_t$ [8]	$\phi p_t \tau_t$ [9]	$\phi_t p_t \tau_t$ [10]	$\Delta QAIC_C$
Spotted Towhee	19.77*	57.32	57.68	59.79	218.50	273.50	272.40	undf.	37.55
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Chipping Sparrow	32.76*	53.74	54.14	57.18	113.50	125.60	123.80	317.80	20.98
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Song Sparrow	74.16*	91.52	86.95	91.23	106.50	113.80	109.10	133.50	17.36
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Lazuli Bunting	61.20*	71.27	78.13	80.29	112.40	119.90	124.30	204.50	10.07
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	
Brown-headed Cowbird	36.02*	65.15	67.34	70.73	186.50	221.30	221.90	undf.	29.13
	(1.000)	(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] $\phi p \tau$ Model: Transient model with temporally-constant survival probability, recapture probability, and proportion of residents (invariable from year to year).

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

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

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

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

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

Table 10. (cont.) Summary statistics for survival analyses with temporally variable survival and recapture probabilities and proportion of residents in transient models using 12 years (1993-2004) of mark-recapture data from two (Safe Harbor Marsh and Crow Creek) MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. $QAIC_C$[1] and $(GOF)^2$ are presented for all models.

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

[10] $\phi_t p_t \tau_t$ 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 $\phi p \tau$ model and the $\phi_t p \tau$ 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 captures 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 12 years (1993-2004) 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	27	38	6	$\phi p \tau$	38.52	0.520 (0.170)	32.7	0.277 (0.191)	1.000 (0.767)
"Traill's" Flycatcher	2	88	127	7	$\phi p \tau$	37.52	0.378 (0.145)	38.2	0.621 (0.269)	0.164 (0.116)
Black-capped Chickadee	2	112	207	44	$\phi p \tau$	115.00	0.591 (0.060)	10.2	0.455 (0.080)	0.649 (0.162)
House Wren †	1	68	102	5	$\phi p \tau$	36.30	0.362 (0.178)	49.2	0.143 (0.147)	1.000 (1.002)
Swainson's Thrush	1	32	51	7	$\phi p \tau$	46.04	0.609 (0.134)	22.0	0.369 (0.177)	0.336 (0.226)
American Robin	2	102	129	12	$\phi p \tau$	65.49	0.720 (0.114)	15.9	0.250 (0.105)	0.218 (0.112)
Gray Catbird	2	114	158	13	$\phi p \tau$	64.64	0.487 (0.129)	26.5	0.295 (0.139)	0.545 (0.301)
Yellow Warbler	1	82	132	16	$\phi p \tau$	82.29	0.608 (0.101)	16.6	0.225 (0.092)	0.694 (0.318)
Common Yellowthroat	1	73	127	22	$\phi p \tau$	88.89	0.562 (0.082)	14.6	0.338 (0.102)	0.730 (0.271)
Spotted Towhee †‡	2	31	42	2	$\phi p \tau$	19.77	0.480 (0.327)	68.1	0.097 (0.163)	1.000 (1.609)
Chipping Sparrow †‡	2	45	52	5	$\phi p \tau$	32.76	0.281 (0.184)	65.6	0.369 (0.360)	1.000 (1.182)
Song Sparrow	2	98	189	27	$\phi p \tau$	74.16	0.489 (0.077)	15.7	0.640 (0.120)	0.438 (0.152)
Lazuli Bunting	1	51	88	14	$\phi p \tau$	61.20	0.445 (0.115)	25.9	0.566 (0.177)	0.891 (0.407)
Brown-headed Cowbird	2	29	38	6	$\phi p \tau$	36.02	0.470 (0.169)	35.9	0.377 (0.240)	0.767 (0.583)

[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.

[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.

Table 11. (cont.) Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captures 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 12 years (1993-2004) of mark-recapture data.

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[5] Models included are those chosen by $QAIC_C$ (those models marked with * in Table 9) plus the $\phi p\tau$ model in all cases. See Table 9 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 presented as the maximum likelihood estimate (standard error of the estimate).

[8] The coefficient of variation for survival probability.

[9] Recapture probability presented as the maximum likelihood estimate (standard error of the estimate).

[10] The proportion of residents among newly captured adults 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 ($SE(\phi)>0.200$ or $CV(\phi)>50.0\%$).

† The estimate for survival probability, recapture probability, or both may be biased low because the estimate for τ was 1.000.

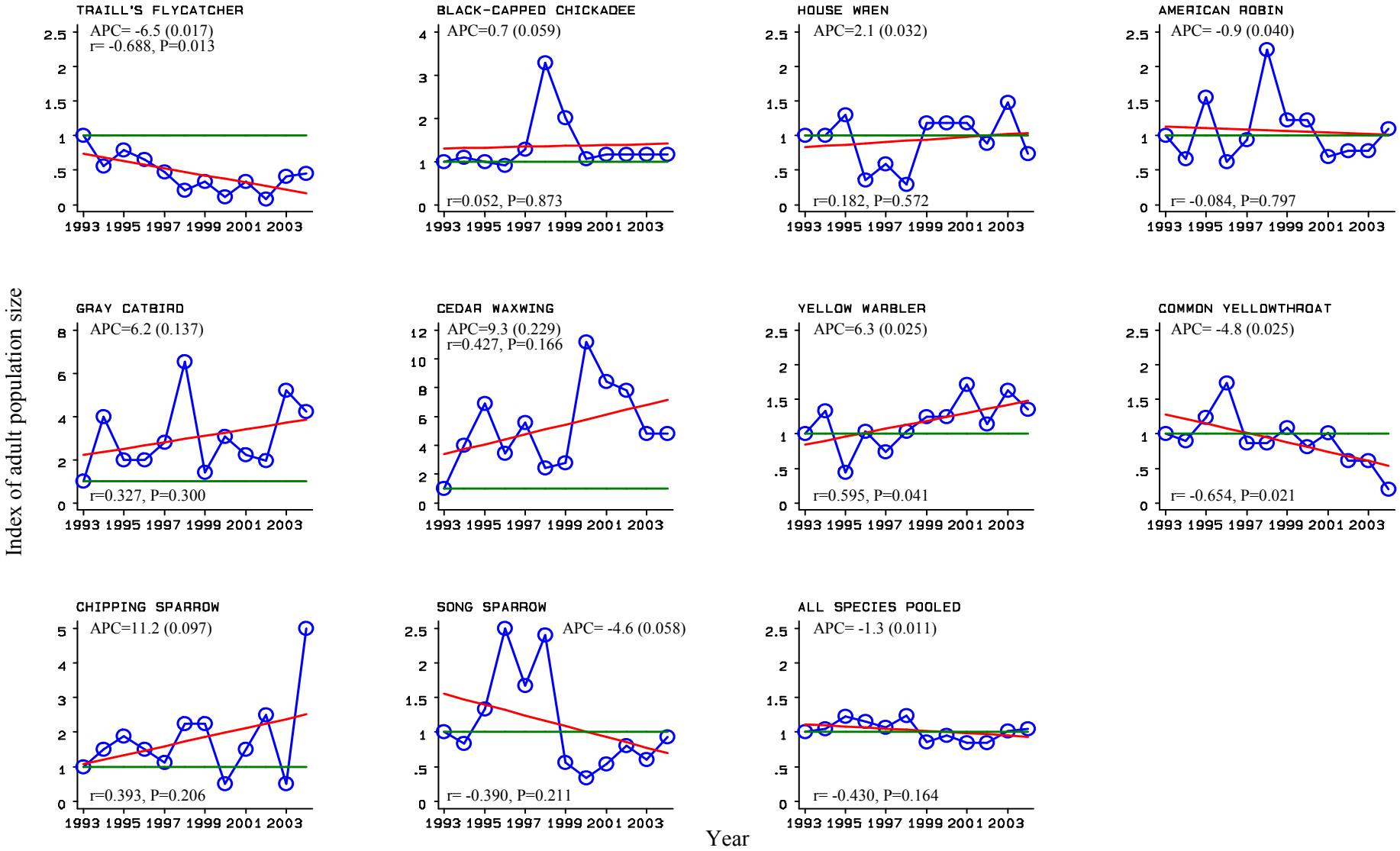

Figure 1. Population trends for ten species and all species pooled from two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the 12 years 1993-2004. The index of population size was arbitrarily defined as 1.0 in 1993. Indices 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.

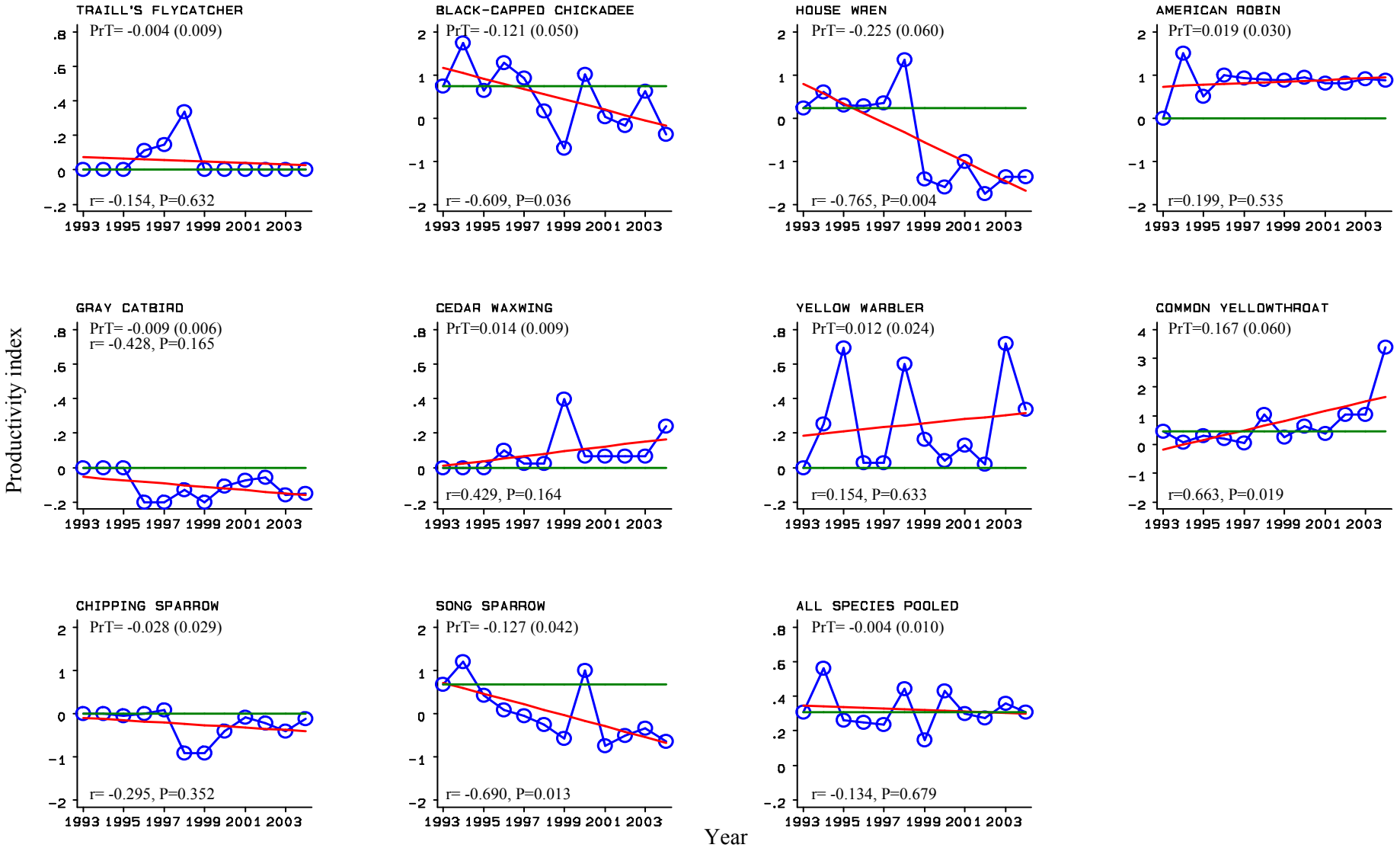

Figure 2. Trend in productivity for ten species and all species pooled from two MAPS stations (Safe Harbor Marsh and Crow Creek) on the Flathead Reservation of the Confederated Salish and Kootenai Tribes over the 12 years 1993-2004. The productivity index was defined as the actual productivity value 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.