THE 2002 ANNUAL REPORT OF THE MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM AT NAVAL SECURITY GROUP ACTIVITY (NSGA) SUGAR GROVE

David F. DeSante, Peter Pyle, and Danielle O'Grady

THE INSTITUTE FOR BIRD POPULATIONS
P.O. Box 1346
Point Reyes Station, CA 94956-1346

(415) 663-1436

ddesante@birdpop.org

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EXECUTIVE SUMMARY

Since 1989, The Institute for Bird Populations has been coordinating the Monitoring Avian Productivity and Survivorship (MAPS) Program, a cooperative effort among public and private agencies and individual bird banders in North America, to operate a continent-wide network of constant-effort mist-netting and banding stations. The purpose of the MAPS program is to provide annual indices of adult population size and post-fledging productivity, as well as estimates of adult survivorship and recruitment into the adult population, for various landbird species. Broad-scale data on productivity and survivorship are not obtained from any other avian monitoring program in North America and are needed to provide crucial information upon which to initiate research and management actions to reverse the recently-documented declines in North American landbird populations. The system of military installations in the United States may provide one group of ideal locations for this large-scale, long-term biomonitoring because they provide large areas of breeding habitat for Neotropical migratory landbirds that are subject to varying management practices.

A second objective of the MAPS program is to provide standardized population and demographic data for the landbirds found on federally managed public lands, such as military installations, national forests, national parks, and wildlife refuges. In this vein, it is expected that population and demographic data on the landbirds found on any given military installation will aid research and management efforts on the installation to protect and enhance its avifauna and ecological integrity while simultaneously helping it fulfill its military mission in an optimal manner.

We re-established and operated two MAPS stations at Navy Security Group Activity (NSGA) Sugar Grove in 2001: the South Fork Potomac River station in bottomland riparian/mixed forest habitat, and the Beaver Creek station in ridgetop/open forest habitat. Ten mist nets at each station, set up in the exact same locations at which they were established in 2001, were operated for six morning hours per day, on one day per 10-day period, and for seven consecutive 10-day periods between June 5 and August 1.

A total of 123 individual birds of 29 species were newly banded at the two stations during the summer of 2002, various individuals of these species were recaptured a total of 35 times, and 13 birds (mostly hummingbirds which we do not band) were captured and released unbanded. Thus, a total of 171 captures of 29 species was recorded. The greatest number of captures by far was recorded at the South Fork Potomac River station (148 captures of 23 species), while the Beaver Creek station had 23 captures of 14 species.

The index of adult population size for all species pooled in 2001 at the South Fork Potomac River station was 120.8 birds per 600 net hours, nearly six times as high as that at the Beaver Creek station (20.3 birds per 600 net hours). Species richness of adults at the South Fork Potomac River station (21 species) was nearly three times as high as the Beaver Creek station (8 species). These results were

similar to results from 2001 and suggest that the habitat at the South Fork Potomac River station can support a larger and more varied adult breeding population than the habitat at the Beaver Creek Station. This may be a result of higher habitat diversity and a denser more diverse understory at the South Fork Potomac River station, as compared to the Beaver Creek station. In contrast, however, productivity tended to be rather similar at the two stations in both 2001 and 2002.

Comparisons between 2001 and 2002 at NSGA Sugar Grove revealed that breeding populations increased slightly at South Fork Potomac River and decreased substantially at Beaver Creek, whereas productivity decreased substantially at South Fork Potomac River and increased substantially at Beaver Creek. This type of alternating two-year cycle has often been observed at other MAPS locations and reflects a density dependent population dynamic. It is interesting to note that this pattern has been established on opposite temporal cycles at the two stations. Because of the much larger numbers of birds captured at the South Fork Potomac River station compared to the Beaver Creek station, overall changes on the installation between 2001 and 2002 tended to resemble those at the South Fork Potomac River station more than at the Beaver Creek station. Changes between 2001 and 2002 in breeding population sizes and productivity at Shenandoah National Park were also more in line with results at South Fork Potomac River than at Beaver Creek. Perhaps the Beaver Creek station, because it supports a lower abundance of breeding birds, is influenced more by transient or poorer-quality individuals, which might be affecting the population dynamic at this station.

As more years of data accumulate we will be able to examine additional between-year changes in these indices in order to make inferences about the effects of weather on productivity and the effect of changes in productivity on population size. We will also be able examine trends in breeding population size and productivity to make inferences about the long-term prospects of the various species, and will be able to examine annual survival-rate estimates, recapture probabilities, and proportion of residents in order to make inferences regarding the effect of survivorship on population dynamics. Pooling data at this level will also allow comparison between NSGA Sugar Grove and other regional stations that may participate in the MAPS program in the future, as well as comparisons between NSGA Sugar Grove and other unprotected areas in the region. Finally, MAPS data from NSGA Sugar Grove will be pooled with MAPS data from outside the installation to provide regional (or even continental) indices and estimates of (and longer-term trends in) these key demographic parameters.

The long-term goal for the NSGA Sugar Grove MAPS program is to continue to monitor the primary demographic parameters of landbirds in order to provide critical information to clarify the ecological processes leading from environmental stressors to population responses. We will accomplish this by including NSGA Sugar Grove data in analyses of other central Appalachian stations to: (a) determine spatial patterns in productivity indices and survival rate estimates as a function of spatial patterns in population trends for target species; (b) determine the proximate demographic factor (i.e., productivity or survivorship) causing observed population trends; (c) link MAPS data with landscape-level habitat data and spatially explicit weather data in a geographical information system (GIS); (d) identify relationships between landscape-level habitat and/or weather characteristics and the primary demographic responses (productivity and survival rates) of target species; (e) generate hypotheses regarding the ultimate environmental causes of the population trends; and (f) make comprehensive recommendations for habitat and use-related management goals both at the installation and central Appalachian scale.

In addition, MAPS data from NSGA Sugar Grove will provide an important contribution to the determination of accurate indices of adult population size and productivity and precise estimates of adult survival rates on a region-wide basis (e.g., northeastern North American) for a substantial number of landbird species. We conclude that the MAPS protocol is well-suited to provide an integral component of NSGA Sugar Grove's long-term ecological monitoring effort. Based on the above information, we recommend the continued operation of the NSGA Sugar Grove MAPS stations well into the future.

INTRODUCTION

The United States Department of Defense (DoD), including the Department of the Navy, has assumed responsibility for managing natural resources on lands under their jurisdiction in a manner that, as much as possible considering their military mission, maintains the ecological integrity and species diversity of the ecosystems present on those lands. In order to carry out this responsibility, integrated long-term programs are needed to monitor the natural resources on military installations and to monitor the effects of varying management practices on those resources.

The development and implementation of an effective long-term monitoring program on military installations can be of even wider importance than aiding the Department of Defense in its management of those resources. Because military lands often provide large areas of multiple and often relatively pristine 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 large-scale, even global, environmental changes. Thus, long-term monitoring data from military installations can provide information that is crucial for efforts to preserve natural resources and biodiversity on a continental or even global scale.

Landbirds

Landbirds, because of their high body temperature, rapid metabolism, and high ecological position on most food webs, may be excellent indicators of the effects of local, regional, and global environmental change in terrestrial ecosystems. Furthermore, their abundance and diversity in virtually all terrestrial habitats, diurnal nature, discrete reproductive seasonality, and intermediate longevity facilitate the monitoring of their population and demographic parameters. It is not surprising, therefore, that landbirds have been selected by the DoD 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. As one of the major cooperating agencies in PIF, the DoD has defined its role in the program to include the establishment of long-term avian monitoring efforts at military installations using protocols developed by the Monitoring Working Group of PIF. Clearly, the long-term monitoring goals of the DoD and the monitoring and research goals of PIF share many common elements.

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.

MAPS

In 1989, The Institute for Bird Populations (IBP) established the Monitoring Avian Productivity and Survivorship (MAPS) program, a cooperative effort among public agencies, private organizations, and individual bird banders in North America to operate a continent-wide network of constant-effort mist-netting and banding stations to provide long-term demographic data on landbirds (DeSante et al. 1995). The design of the MAPS program was patterned after the very successful British Constant Effort Sites (CES) Scheme that has been operated by the British Trust for Ornithology since 1981 (Peach et al. 1996). The MAPS program was endorsed in 1991 by both the Monitoring Working

Group of PIF and the USDI Bird Banding Laboratory, and a four-year pilot project (1992-1995) was approved by the USDI Fish and Wildlife Service and National Biological Service (now the Biological Resources Division [BRD] of the U.S. Geological Survey [USGS]) to evaluate its utility and effectiveness for monitoring demographic parameters of landbirds.

Now in its thirteenth year (tenth year of standardized protocol and extensive distribution of stations), the MAPS program has expanded greatly from 178 stations in 1992 to over 500 stations in 2002. The substantial growth of the Program since 1992 was caused by its endorsement by PIF and the subsequent involvement of various federal agencies in PIF, including the Department of Defense, Department of the Navy, Department of the Army, Texas Army National Guard, National Park Service, USDA Forest Service, and US Fish and Wildlife Service. Within the past ten years, for example, IBP has been contracted to operate as many as 157 MAPS stations per year on federal properties, including 76 stations on military installations administered by the DoD and the Texas Army National Guard.

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 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 DoD military installations, along with national parks, national forests, and other publicly owned lands, will 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 military installations, national forests, or national parks) to aid research and management efforts within the installations, forests, or parks 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. DeSante et al. (1999) showed that measures of productivity and survival derived from MAPS data were consistent with observed populations changes at these smaller spatial scales. This provides considerable assurance that the goals and objectives outlined above can be achieved.

Both long-term objectives are in agreement with the Department of Defense's avian monitoring program. Accordingly, the MAPS program was established on Naval Security Group Activity (NSGA) Sugar Grove in 2001. It is expected that information from the MAPS program will be capable of aiding research and management efforts on NSGA Sugar Grove to protect and enhance the installation's avifauna and ecological integrity, while helping it fulfill its military mission in an optimal manner.

SPECIFICS OF THE NSGA SUGAR GROVE MAPS PROGRAM

Two MAPS stations were established and operated in NSGA Sugar Grove in 2002, at the same locations at which they were established in 2001 by Jack Markham (Horticulturalist/Urban Forester, Atlantic Division, Naval Facilities Engineering Command) and Steve Niethamer (Environmental Programs Manager at NSGA Sugar Grove), with the assistance of MAPS field biologists, Amy McAndrews and Amy Finfera. The stations were re-established by IBP field biologist Blair Hayman with the help of field biologist interns, Danika Tsao, Ron Meker, and Caitlin Kight during the first week of June, 2002. The two stations are located as follows: (1) the South Fork Potomac River station on the main base in a riparian corridor of mixed forest bordering the southern branch of the Potomac River southern fork; and (2) the Beaver Creek station bordering the George Washington National Forest in open mixed forest. A summary of the major habitats represented at each of the two stations is presented in Table 1 along with a summary of the 2002 operation of each station.

The three field biologist interns, who were also responsible for operating the six MAPS stations in Shenandoah National Park, received two weeks of intensive training in a comprehensive course in mist netting and bird-banding techniques given by IBP biologists Danielle O'Grady, Amy Finfera, and Blair Hayman, which took place May 1-14 at the Jug Bay Wetlands Sanctuary in southern Maryland. The interns then received two weeks of further training while setting-up and operating actual MAPS stations at Indian Head Naval Weapons Support Center, Maryland, Dahlgren Naval Surface Warfare Center, Fort Belvoir, and Shenandoah National Park, all in Virginia. The interns began operation of the NSGA Sugar Grove stations on June 5, and received supervision by Blair Hayman for the duration of the field season.

All ten net sites at each station were established without difficulty at the exact same locations where they were operated in 2001. Each station was operated for six morning hours per day (beginning at local sunrise) on one day in each of seven consecutive 10-day periods between Period 4 (May 31-June 9) and Period 10 (July 30 - Aug. 8). The operation of all stations occurred on schedule during each of the seven 10-day periods.

METHODS

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

Data Collection

With few exceptions, all birds captured during the course of the study were identified to species, age, and sex and, if unbanded, were banded with USGS/BRD numbered aluminum bands. Birds were released immediately upon capture and before being banded if situations arose where bird safety would be comprised. Such situations could involve exceptionally large numbers of birds being captured at once, or the sudden onset of adverse weather conditions such as high winds or heavy rainfall. The following data were taken on all birds captured, including recaptures, according to MAPS guidelines using standardized codes and forms (DeSante et al. 2002):

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

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

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

Computer Data Entry and Verification

The computer entry of all banding data was completed by John W. Shipman of Zoological Data Processing, Socorro, NM. The critical data for each banding record (capture code, band number, species, age, sex, date, capture time, station, and net number) were proofed by hand against the raw data and any computer-entry errors were corrected. Computer entry of effort, 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 summary of mist netting effort data;
(3) Cross-check programs to compare species, age, and sex determinations against degree of skull pneumaticization, breeding condition (extent of cloacal protuberance and brood patch), and extent of body and flight-feather molt, primary-feather wear, and juvenal plumage for each record;
(4) Screening programs which allow identification of unusual or duplicate band numbers or unusual band sizes for each species; and
(5) Verification programs to screen banding and recapture data from all years of operation for inconsistent species, age, or sex determinations for each band number.

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

Data Analysis

To facilitate analyses, we first classified the landbird species captured in mist nets into five groups based upon their breeding or summer residency status. Each species was classified as one of the following: a regular breeder (B) if we had positive or probable evidence of breeding or summer residency within the boundaries of the MAPS station *during all years* that the station was operated; a usual breeder (U) if we had positive or probable evidence of breeding or summer residency within the boundaries of the MAPS station *during more than half but not all of the years* that the station was operated; an occasional breeder (O) if we had positive or probable evidence of breeding or summer residency within the boundaries of the MAPS station *during half or fewer of the years* that the station was operated; a transient (T) if the species was *never* a breeder or summer resident at the station, but the station was within the overall breeding range of the species; and a migrant (M) if the station was not located within the overall breeding range of the species. At NSGA Sugar Grove, the status codes 'U' and 'O' were not used since the stations have only been in operation for one year. Data from a station for a species classified as a migrant 'M' at the station were not included in any analyses, except those used to produce Table 2.

<u>A. Population-Size and Productivity Analyses</u> — The proofed, verified, and corrected banding data from 2002 were run through a series of analysis programs that calculated for each species and for all species combined at each station and for all stations pooled:

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

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

For each station, we calculated percent changes between 2001 and 2002 in the numbers of adult and young birds captured, and actual changes in the proportion of young in the catch. These between-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. We determined the statistical significance of between-year changes according to methods developed by the BTO in their CES scheme (Peach et al. 1996). Thus, for species captured at both stations at NSGA Sugar Grove, we statistically inferred the significance of installation-wide annual changes in the indices of adult population size and post-fledging productivity by using confidence intervals derived from the standard errors of the mean percentage changes. Because of the sample size of only two stations, between-year changes for any given species at NSGA Sugar Grove are unlikely to reach statistical significance unless the changes at the two stations are substantial and very nearly the same. 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, and we use the term "near-significant" or "nearly significant" for differences for which $0.05 \leq P < 0.10$.

<u>B. Analyses of Trends in Adult Population Size and Productivity</u> — When three or more years of data have been collected we will be able to calculate "chain indices" for adult population size and

productivity based on the corresponding constant-effort year-to-year changes. We will then use the slopes of the regression lines of these chain indices as measures of the population trend or trend in productivity for each study species.

C. Survivorship Analyses — When three years of data have been collected, we will also be able to estimate survival and recapture probability using standard Cormack-Jolly Seber (CJS) mark-recapture models. The survival estimates obtained from standard CJS models are biased low by the presence of transient (non-resident) individuals in the sample of captured birds. When four or more consecutive years of data have been collected, we will be able to use both within- and between-year transient models in modified CJS mark-recapture analyses to produce unbiased estimates of adult survival rates and estimates of the proportion of residents among newly captured adults. With five or more years of data, we will also be able to begin to examine time-dependence in survival- and recapture-rate estimates and estimates of the proportion of residents.

RESULTS

A total of 716.7 net-hours was accumulated at the two MAPS stations operated at NSGA Sugar Grove in 2002 (Table 1). Data from 688.7 of these net-hours could be compared directly to 2001 data in a constant-effort manner.

The 2002 capture summary of the numbers of newly-banded, unbanded, and recaptured birds is presented for each species and all species pooled at each of the two stations in Table 2. A total of 148 captures of 23 species was recorded at the South Fork Potomac River station, while Beaver Creek produced only 23 captures of 14 species. Overall, the most abundantly captured species at the two stations were, in order of abundance: Worm-eating Warbler, Carolina Wren, Ovenbird, Indigo Bunting, Song Sparrow, and Gray Catbird (Table 2).

In order to standardize the number of captures with respect to variability of mist-netting effort expended at the two stations (due to unsuitable weather conditions and accidental net damage; see Table 1), we present capture rates (per 600 net-hours) of individual adult and young birds, as well as the percentage of young in the catch, for each species and for all species pooled at each station in Table 3. These capture indices suggest that the total adult population size in 2002 (120.8 birds per 600 net hours) was almost six times as high at South Fork Potomac River as at Beaver Creek (20.3 birds per 600 net hours). Species richness of adults at the South Fork Potomac River station (21 species) was nearly three times as high as the Beaver Creek station (8 species). Captures of young of all species pooled at South Fork Potomac River in 2002 was almost five times as high as at Beaver Creek. Thus, the index of productivity, as determined by the percentage of young in the catch, was slightly higher at Beaver Creek (0.40) than at South Fork Potomac River (0.36).

The following is a list of the common breeding species (captured at a rate of at least 6.0 adults per 600 net-hours), in decreasing order, at each station in 2002 (see Table 2):

South Fork Potomac Branch	Beaver Creek
Ovenbird	Worm-eating Warbler
Indigo Bunting	
Carolina Wren	
Worm-eating Warbler	
Gray Catbird	
Song Sparrow	

Constant-effort comparisons between 2001 and 2002 were undertaken at both NSGA Sugar Grove stations for numbers of adult birds captured (index of adult population size; Table 4), numbers of young birds captured (Table 5), and proportion of young in the catch (productivity index; Table 6).

Adult population size for all species pooled at both stations combined decreased slightly between 2001 and 2002 by -2.4% (Table 4). Decreases were recorded for 13 of 30 species, a proportion not significantly greater than 0.50. The number of adults captured of all species pooled increased at South Fork Potomac River by +7.4% but decreased substantially at Beaver Creek by -41.2%. The proportion of increasing and decreasing species was not significantly greater than 0.50 at either station. Among individual species, consistent decreases in adults at both stations were recorded for Black-capped Chickadee and Scarlet Tanager, while a consistent increase was recorded for Ovenbird.

The number of young birds captured of all species pooled for all stations combined decreased by -43.0%, a substantial change (Table 5). Decreases between 2001 and 2002 were recorded for 15 of 22 species, a proportion near-significantly greater than 0.50. In contrast to adults captured, the overall change in young captured for all species pooled decreased at South Fork Potomac River by -48.1%, whereas it increased at Beaver Creek by +14.3%. The proportion of decreasing species at South Fork Potomac River was nearly significantly greater than 0.50. Among individual species at both stations pooled, a consistent decrease in young captured at both stations was recorded for Tufted Titmouse, while a consistent increase was recorded for Carolina Wren.

Productivity (the proportion of young in the catch) also showed a substantial decrease of -0.132 from 0.503 in 2001 to 0.371 in 2002 for all species pooled and all stations combined (Table 6). Decreases in productivity were recorded for 10 of 15 species, a proportion not significantly greater than 0.50. As with young captured, a decrease in productivity was noted at South Fork Potomac River (by -0.178), whereas an increase was recorded at Beaver Creek (by +0.153). The proportion of decreasing and increasing species, respectively, was not greater than 0.50 at either station. Among individual species at both stations pooled, a consistent decrease in young captured at both stations was recorded for Tufted Titmouse, while a consistent increase was recorded for Ovenbird.

Thus, in general, breeding populations increased slightly at South Fork Potomac River and decreased substantially at Beaver Creek, whereas productivity decreased substantially at South Fork Potomac River and increased substantially at Beaver Creek. Because about 80% of the data were collected at South Fork Potomac River, changes between 2001 and 2002 at NSGA Sugar Grove overall were much more influenced by the dynamics at this station than at Beaver Creek.

DISCUSSION

As in 2001, both species richness and the abundance of adult birds at the South Fork Potomac River station, located in bottomland riparian/mixed forest habitat, was substantially higher than that at the Beaver Creek station, located in ridgetop/open forest habitat. This suggests that the bottomland riparian/mixed forest habitat can support substantially larger breeding populations than the ridgetop/open forest habitat. The paucity of the understory vegetation in the ridgetop habitat, as compared with the thick understory layer in the bottomland habitat, may be a major factor limiting the ability of the ridgetop habitat to support large breeding populations. However, it is also possible that the windier, more exposed conditions at the ridgetop station and the paucity of understory vegetation there caused much lower capture probabilities than at the bottomland station, and that the low observed capture rates reflected this difference in capture probability rather than lower actual population sizes. A better understanding of this will be achieved after three or four years of data have been collected, enabling us to perform survivorship analyses that include estimates of recapture probabilities.

Comparisons between the two years of operation at NSGA Sugar Grove revealed that adult population sizes in 2002 increased slightly at South Fork Potomac River and decreased substantially at Beaver Creek, whereas productivity decreased substantially at South Fork Potomac River and increased substantially at Beaver Creek. This type of alternating two-year cycle has often been observed at other MAPS locations. Increased productivity one year causes increased recruitment and thus increased population sizes the next year, which in turn results in decreased productivity due to more competition and a higher proportion of first-time breeders. This decreased productivity then results in lower breeding populations the following year that show higher productivity, and so on. It is interesting to note that this pattern, if genuine, has been established on opposite temporal cycles at the two stations. This may result in a very interesting population dynamic for future study at this installation. Should this pattern continue we should expect to see lower breeding populations with higher productivity in 2003 at South Fork Potomac River and the opposite at Beaver Creek. On the other hand, we have also found at other MAPS stations that unusual climatic events or weather conditions often disrupt this alternating pattern.

We found that adult population sizes at the six stations at roughly similar elevations in Shenandoah National Park remained roughly stable between 2001 and 2002 (although five species showed substantial decreases vs. none with substantial increases), whereas the number of young captured and productivity both appeared to show a species-wide decline between these two years. These results are more in line with results at South Fork Potomac River than at Beaver Creek. Perhaps the Beaver Creek station, because it supports a lower abundance of breeding birds, is influenced more by transient or poorer-quality individuals, which might be affecting the population dynamic at this station. Again more years of data will allow us to estimate the proportion of transients at the two stations and address this hypothesis.

Despite the fact that the NSGA Sugar Grove MAPS stations have been operated for only two years, interesting data have been gathered on adult populations and productivity for a number of summer resident landbirds at the installation. We were now able to use two years of data to compare differences in adult population size and productivity between the two stations on NSGA Sugar Grove and to pooled data from the two stations to provide installation-wide indices of breeding population size and productivity. This year we were also able to compare data from 2001 to data from 2002 at each station and at both stations combined. As more years of data accumulate we will be able to examine additional between-year changes in these indices in order to make inferences about the effects of weather on productivity and the effect of changes in productivity on population size. We will also be able to examine trends in breeding population size and productivity in order to make inferences about the long-term prospects of the various species. Finally, we will be able to examine annual survival-rate estimates, recapture probabilities, and proportion of residents among newly captured adults in order to make inferences regarding the effect of survivorship on population dynamics. Pooling data at this level will also allow comparison between NSGA Sugar Grove and other regional stations that may participate in the MAPS program in the future, as well as comparisons between NSGA Sugar Grove and other unprotected areas in the region. Finally, MAPS data from NSGA Sugar Grove will be pooled with MAPS data from outside the installation to provide regional (or even continental) indices and estimates of (and longer-term trends in) these key demographic parameters.

The long-term goal for the NSGA Sugar Grove MAPS program is to continue to monitor the primary demographic parameters of NSGA Sugar Grove's landbirds in order to provide critical information that can be used to aid our understanding of the ecological processes leading from environmental stressors to population responses. This is to be accomplished by including data from NSGA Sugar Grove with additional MAPS data from other central Appalachian stations to: (1) investigate spatial patterns in productivity indices and survival rate estimates as a function of spatial patterns in populations trends for target species (DeSante et al. 2001); (2) determine the proximate demographic factor (i.e., productivity or survivorship) causing observed population trends in the target species (DeSante et al. 2001); (3) link MAPS data with landscape-level habitat data and spatially explicit weather data in a geographical information system (GIS) (Nott 2002); (4) identify relationships between landscape-level habitat and/or weather characteristics and the primary demographic responses (productivity and survival rates) of the target species (Nott 2002, Nott et al. 2002b); (5) generate hypotheses regarding the ultimate environmental causes of the population trends; and (6) make comprehensive recommendations for habitat and use-related management strategies both on the installation and elsewhere (Nott 2000). We conclude that the MAPS protocol is very well-suited to provide one component of NSGA Sugar Groves' long-term ecological monitoring goals, and recommend continuing the program well into the future.

CONCLUSIONS AND RECOMMENDATIONS

(1) Data from the two MAPS stations on NSGA Sugar Grove were used to provide station-specific and installation-wide indices of adult population size and productivity for 2002, and to compare these values with those obtained in 2001. In 2002, the index of adult population size for all species pooled at the South Fork Potomac River station, located in bottomland/mixed forest habitat, was 120.8 birds per 600 net hours, nearly six times as high as that at the Beaver Creek station (20.3 birds per 600 net hours), located in ridgetop/open forest habitat. Species richness of adults at the South Fork Potomac River station (21 species) was nearly three times as high as the Beaver Creek station (8 species). This was similar to the results found in 2001. Productivity indices in 2002 were roughly similar but slightly higher at the Beaver Creek (0.40) than at the South Fork Potomac River station (0.36). This result was also similar to that in 2001 but reversed (0.56 at South Fork Potomac River and 0.49 and Beaver Creek in 2001).

(2) Constant-effort comparisons between the two years of operation at NSGA Sugar Grove revealed that breeding populations increased slightly at South Fork Potomac River and decreased substantially at Beaver Creek, whereas productivity decreased substantially at South Fork Potomac River and increased substantially at Beaver Creek. This type of alternating two-year cycle has often been observed at other MAPS locations and reflects a density dependent population dynamic. It is interesting to note that this pattern appears to have been established on opposite temporal cycles at the two stations. Because of the much larger numbers of birds captured at South Fork Potomac River than at Beaver Creek, the overall pattern on the installation was of a very small decrease in adult population size and a substantial decreases in productivity at NSGA Sugar Grove in 2002 as compared to 2001.

(3) Changes between 2001 and 2002 in breeding population sizes and productivity at Shenandoah National Park were more in line with results at South Fork Potomac River than at Beaver Creek. Perhaps the Beaver Creek station, because it supports a lower abundance of breeding birds, is influenced more by transient or poorer-quality individuals, which might be affecting the population dynamic at this station.

(4) As more years of data accumulate we will be able to examine (1) additional between-year changes in these indices in order to make inferences about effects of weather, (2) trends in breeding population size and productivity to make inferences about the long-term population viability, and (3) annual survival-rate estimates, capture probabilities, and proportion of residents in order to make inferences regarding the effect of survivorship on population dynamics. MAPS data from NSGA Sugar Grove will also be pooled with MAPS data from outside the installation to provide regional (or even continental) indices and estimates of (and longer-term trends in) these key demographic parameters.

(5) The long-term goal for the NSGA Sugar Grove MAPS program is to continue to monitor the primary demographic parameters of NSGA's landbirds in order to provide critical information to

clarify the ecological processes leading from environmental stressors to population responses. We intend to accomplish this by including NSGA Sugar Grove data in analyses of other central Appalachian stations to: (a) determine spatial patterns in productivity indices and survival rate estimates as a function of spatial patterns in population trends for target species; (b) determine the proximate demographic factor (i.e., productivity or survivorship) causing observed population trends; (c) link MAPS data with landscape-level habitat data and spatially explicit weather data in a geographical information system (GIS); (d) identify relationships between landscape-level habitat and/or weather characteristics and the primary demographic responses (productivity and survival rates) of target species; (e) generate hypotheses regarding the ultimate environmental causes of the population trends; and (f) make comprehensive recommendations for habitat- and use-related management goals both at the installation and central Appalachian scale.

(6) In addition, MAPS data from NSGA Sugar Grove will provide an important contribution to the determination of accurate indices of adult population size and productivity and precise estimates of adult survival rates on a region-wide basis (e.g., northeastern North American) for a substantial number of landbird species.

(7) We conclude that the MAPS protocol is well-suited to provide an integral component of NSGA Sugar Grove's long-term ecological monitoring effort. Based on the above information, we recommend the continued operation of the NSGA Sugar Grove MAPS stations well into the future.

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Table 1. Summary of the 2002 MAPS program on Naval Security Group Activity Sugar Grove.

Station						2002 operation		
Name	Code	No.	Major Habitat Type	Latitude-longitude	Avg. Elev. (m)	Total number of net-hours[1]	No. of periods	Inclusive dates
South Fork Potomac River	SFPR	15627	Gentle slope, riparian corridor, mixed forest, hayfield edge	38°34'44"N, 79°16'13"W	536	362.7 (362.0)	7	6/05-7/31
Beaver Creek	BECR	15628	Steep slope, open mixed	38°30'40"N, 79°16'26"W	658	354.0 (326.7)	7	6/06-8/01
ALL STATIONS COMBINED						716.7 (688.7)	7	6/05-8/01

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

Table 2. Capture summary for the two individual MAPS stations, and both stations pooled, operated on Naval Security Group Activity Sugar Grove in 2002.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	South Fork Potomac River			Beaver Creek			Both Stations Pooled		
Species	N	U	R	N	U	R	N	U	R
Ruby-throated Hummingbird		2						2	
Yellow-bellied Flycatcher				1			1		
Eastern Phoebe	1						1		
Great Crested Flycatcher	1						1		
White-eyed Vireo			3						3
Blue-headed Vireo					1			1	
Red-eyed Vireo	1						1		
Blue Jay	1			1			2		
Carolina Chickadee				2			2		
Black-capped Chickadee			1			1			2
Tufted Titmouse	2					1	2		1
Carolina Wren	13	2	5	1			14	2	5
Blue-gray Gnatcatcher				1			1		
American Robin	1						1		
Gray Catbird	8		3				8		3
Brown Thrasher	3						3		
Northern Parula				1			1		
Yellow Warbler	1						1		
Black-and-white Warbler	2						2		
Worm-eating Warbler	25	3	11	5			30	3	11
Ovenbird	13	1		4	1		17	2	
Louisiana Waterthrush	3			1			4		
Eastern Towhee		1						1	
Chipping Sparrow				1			1		
Song Sparrow	10	1	3				10	1	3
Northern Cardinal	4		4				4		4
Indigo Bunting	13		3	1			14		3
Common Grackle	1						1		
Baltimore Oriole	1						1		
Unidentified Bird		1						1	
ALL SPECIES POOLED	104	11	33	19	2	2	123	13	35
TOTAL NUMBER OF CAPTURES		148			23			171	
NUMBER OF SPECIES	19	6	8	11	2	2	24	7	9
TOTAL NUMBER OF SPECIES		23			14			29	

Table 3. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the two individual MAPS stations, and both stations pooled, operated on Naval Security Group Activity Sugar Grove in 2002.

	South Fork Potomac River			Beaver Creek			Both Stations Pooled		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Ruby-throated Hummingbird									
Yellow-bellied Flycatcher									
Eastern Phoebe	1.7	0.0	0.00				0.8	0.0	0.00
Great Crested Flycatcher	1.7	0.0	0.00				0.8	0.0	0.00
White-eyed Vireo	3.3	0.0	0.00				1.7	0.0	0.00
Blue-headed Vireo	1.7	0.0	0.00						
Red-eyed Vireo	1.7	0.0	0.00	0.0	1.7	1.00	0.8	0.0	0.00
Blue Jay							0.8	0.8	0.50
Carolina Chickadee				0.0	3.4	1.00	0.0	1.7	1.00
Black-capped Chickadee	1.7	0.0	0.00	1.7	0.0	0.00	1.7	0.0	0.00
Tufted Titmouse	1.7	1.7	0.50	1.7	0.0	0.00	1.7	0.8	0.33
Carolina Wren	14.9	11.6	0.44	0.0	1.7	1.00	7.5	6.7	0.47
Blue-gray Gnatcatcher				1.7	0.0	0.00	0.8	0.0	0.00
American Robin	1.7	0.0	0.00				0.8	0.0	0.00
Gray Catbird	13.2	1.7	0.11				6.7	0.8	0.11
Brown Thrasher	3.3	1.7	0.33				1.7	0.8	0.33
Northern Parula				1.7	0.0	0.00	0.8	0.0	0.00
Yellow Warbler	1.7	0.0	0.00				0.8	0.0	0.00
Black-and-white Warbler	3.3	0.0	0.00				1.7	0.0	0.00
Worm-eating Warbler	14.9	31.4	0.68	8.5	0.0	0.00	11.7	15.9	0.58
Ovenbird	16.5	5.0	0.23	1.7	5.1	0.75	9.2	5.0	0.35
Louisiana Waterthrush	3.3	1.7	0.33	0.0	1.7	1.00	1.7	1.7	0.50
Eastern Towhee									
Chipping Sparrow				1.7	0.0	0.00	0.8	0.0	0.00
Song Sparrow	9.9	8.3	0.46				5.0	4.2	0.46
Northern Cardinal	5.0	0.0	0.00				2.5	0.0	0.00
Indigo Bunting	16.5	5.0	0.23	1.7	0.0	0.00	9.2	2.5	0.21
Common Grackle	1.7	0.0	0.00				0.8	0.0	0.00
Baltimore Oriole	1.7	0.0	0.00				0.8	0.0	0.00
Unidentified Bird									
ALL SPECIES POOLED	120.8	67.8	0.36	20.3	13.6	0.40	71.2	41.0	0.37
NUMBER OF SPECIES	21	9		8	5		24	11	
TOTAL NUMBER OF SPECIES		21			12			25	

Table 4. Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at two constant-effort MAPS stations on Naval Security Group Activity Sugar Grove.

			Both stations combined				
				No. adults			
Species	S. Fork Potomac R.	Beaver Creek	n[1]	2001	2002	% change	SE[2]
Yellow-billed Cuckoo		-100.0	1	1	0	-100.0	
Downy Woodpecker			0	0	0		
Hairy Woodpecker		-100.0	1	1	0	-100.0	
Eastern Phoebe	-50.0		1	2	1	-50.0	
Great Crested Flycatcher	++++[3]		1	0	1	++++[3]	
White-eyed Vireo	-50.0		1	4	2	-50.0	
Red-eyed Vireo	++++		1	0	1	++++	
Blue Jay	++++		1	0	1	++++	
Carolina Chickadee			0	0	0		
Black-capped Chickadee	-50.0	-50.0	2	4	2	-50.0	88.9
Tufted Titmouse	0.0	++++[3]	2	1	2	+100.0	200.0
White-breasted Nuthatch			0	0	0		
Carolina Wren	+28.6		1	7	9	+28.6	
House Wren			0	0	0		
Blue-gray Gnatcatcher		++++	1	0	1	++++	
American Robin	++++		1	0	1	++++	
Gray Catbird	-20.0		1	10	8	-20.0	
Brown Thrasher	++++		1	0	2	++++	
Northern Parula		++++	1	0	1	++++	
Yellow Warbler	++++		1	0	1	++++	
Black-throated Green Warbler			0	0	0		
Black-and-white Warbler	-33.3		1	3	2	-33.3	
American Redstart	-100.0		1	1	0	-100.0	
Worm-eating Warbler	+50.0	-25.0	2	10	12	+20.0	36.0
Ovenbird	+150.0	++++	2	4	11	+175.0	50.0
Northern Waterthrush	-100.0		1	1	0	-100.0	
Louisiana Waterthrush	+100.0	-100.0	2	2	2	0.0	100.0
Canada Warbler			0	0	0		
Scarlet Tanager	-100.0	-100.0	2	2	0	-100.0	0.0
Eastern Towhee	-100.0		1	4	0	-100.0	
Chipping Sparrow		0.0	1	1	1	0.0	
Song Sparrow	-33.3		1	9	6	-33.3	
Northern Cardinal	-62.5		1	8	3	-62.5	
Indigo Bunting	+150.0	-83.3	2	10	11	+10.0	112.0
Common Grackle	++++		1	0	1	++++	
Baltimore Oriole	++++		1	0	1	++++	
ALL SPECIES POOLED	+7.4	-41.2	2	85	83	-2.4	15.5

Table 4. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual ADULT birds captured at two constant-effort MAPS stations on Naval Security Group Activity Sugar Grove.

Species	S. Fork Potomac R.	Beaver Creek	Both stations combined
No. species that increased[4]	13(8)	4(4)	15(10)
No. species that decreased[5]	11(4)	7(4)	13(6)
No. species remained same	1	1	2
TOTAL NUMBER OF SPECIES	25	12	30
Proportion of increasing (decreasing) species	0.520	(0.583)	(0.433)
Sig. of increase (decrease)[6]	0.500	(0.387)	(0.819)

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

Table 5. Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at two constant-effort MAPS stations on Naval Security Group Activity Sugar Grove.

			Both stations combined				
				No. young			
Species	S. Fork Potomac R.	Beaver Creek	n[1]	2001	2002	% change	SE[2]
Yellow-billed Cuckoo			0	0	0		
Downy Woodpecker	-100.0		1	2	0	-100.0	
Hairy Woodpecker			0	0	0		
Eastern Phoebe			0	0	0		
Great Crested Flycatcher			0	0	0		
White-eyed Vireo	-100.0		1	1	0	-100.0	
Red-eyed Vireo			0	0	0		
Blue Jay		++++[3]	1	0	1	++++[3]	
Carolina Chickadee		++++	1	0	2	++++	
Black-capped Chickadee		-100.0	1	2	0	-100.0	
Tufted Titmouse	-66.7	-100.0	2	5	1	-80.0	16.0
White-breasted Nuthatch		-100.0	1	1	0	-100.0	
Carolina Wren	+16.7	++++	2	6	8	+33.3	33.3
House Wren	-100.0		1	1	0	-100.0	
Blue-gray Gnatcatcher			0	0	0		
American Robin			0	0	0		
Gray Catbird	-80.0		1	5	1	-80.0	
Brown Thrasher	0.0		1	1	1	0.0	
Northern Parula			0	0	0		
Yellow Warbler			0	0	0		
Black-throated Green Warbler	-100.0		1	1	0	-100.0	
Black-and-white Warbler	-100.0		1	2	0	-100.0	
American Redstart	-100.0		1	1	0	-100.0	
Worm-eating Warbler	-51.3		1	39	19	-51.3	
Ovenbird	-75.0	++++	2	12	6	-50.0	50.0
Northern Waterthrush			0	0	0		
Louisiana Waterthrush	++++[3]	++++	2	0	2	++++	
Canada Warbler	-100.0		1	1	0	-100.0	
Scarlet Tanager			0	0	0		
Eastern Towhee			0	0	0		
Chipping Sparrow		-100.0	1	1	0	-100.0	
Song Sparrow	+150.0		1	2	5	+150.0	
Northern Cardinal	-100.0		1	2	0	-100.0	
Indigo Bunting	++++	-100.0	2	1	3	+200.0	600.0
Common Grackle			0	0	0		
Baltimore Oriole			0	0	0		
ALL SPECIES POOLED	-48.1	+14.3	2	86	49	-43.0	9.3

Table 5. (cont.) Percentage changes between 2001 and 2002 in the numbers of individual YOUNG birds captured at two constant-effort MAPS stations on Naval Security Group Activity Sugar Grove.

Species	S. Fork Potomac R.	Beaver Creek	Both stations combined
No. species that increased[4]	4(2)	5(5)	6(3)
No. species that decreased[5]	12(8)	5(5)	15(11)
No. species remained same	1	0	1
TOTAL NUMBER OF SPECIES	17	10	22
Proportion of increasing (decreasing) species	(0.706)	0.500	(0.682)
Sig. of increase (decrease)[6]	(0.072) *	0.623	(0.067) *

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

Table 6. Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at two constant-effort MAPS stations on Naval Security Group Activity Sugar Grove.

			Both stations combined				
				Prop. of young			
Species	S. Fork Potomac R.	Beaver Creek	n[1]	2001	2002	Absol. change	SE[2]
Yellow-billed Cuckoo		+-+-+[3]	1	0.000	-----	+-+-+[3]	
Downy Woodpecker	+-+-+[3]		1	1.000	-----	+-+-+	
Hairy Woodpecker		+-+-+	1	0.000	-----	+-+-+	
Eastern Phoebe	0.000		1	0.000	0.000	0.000	
Great Crested Flycatcher	+-+-+		1	-----	0.000	+-+-+	
White-eyed Vireo	-0.200		1	0.200	0.000	-0.200	
Red-eyed Vireo	+-+-+		1	-----	0.000	+-+-+	
Blue Jay	+-+-+	+-+-+	2	-----	0.500	+-+-+	
Carolina Chickadee		+-+-+	1	-----	1.000	+-+-+	
Black-capped Chickadee	0.000	-0.500	2	0.333	0.000	-0.333	0.222
Tufted Titmouse	-0.250	-1.000	2	0.833	0.333	-0.500	0.248
White-breasted Nuthatch		+-+-+	1	1.000	-----	+-+-+	
Carolina Wren	-0.024	+-+-+	2	0.462	0.471	+0.009	0.062
House Wren	+-+-+		1	1.000	-----	+-+-+	
Blue-gray Gnatcatcher		+-+-+	1	-----	0.000	+-+-+	
American Robin	+-+-+		1	-----	0.000	+-+-+	
Gray Catbird	-0.222		1	0.333	0.111	-0.222	
Brown Thrasher	-0.667		1	1.000	0.333	-0.667	
Northern Parula		+-+-+	1	-----	0.000	+-+-+	
Yellow Warbler	+-+-+		1	-----	0.000	+-+-+	
Black-throated Green Warbler	+-+-+		1	1.000	-----	+-+-+	
Black-and-white Warbler	-0.400		1	0.400	0.000	-0.400	
American Redstart	+-+-+		1	0.500	-----	+-+-+	
Worm-eating Warbler	-0.188	0.000	2	0.796	0.613	-0.183	0.176
Ovenbird	-0.519	+-+-+	2	0.750	0.353	-0.397	0.187
Northern Waterthrush	+-+-+		1	0.000	-----	+-+-+	
Louisiana Waterthrush	+0.333	+1.000	2	0.000	0.500	+0.500	0.250
Canada Warbler	+-+-+		1	1.000	-----	+-+-+	
Scarlet Tanager	+-+-+	+-+-+	2	0.000	-----	+-+-+	
Eastern Towhee	+-+-+		1	0.000	-----	+-+-+	
Chipping Sparrow		-0.500	1	0.500	0.000	-0.500	
Song Sparrow	+0.273		1	0.182	0.455	+0.273	
Northern Cardinal	-0.200		1	0.200	0.000	-0.200	
Indigo Bunting	+0.231	-0.143	2	0.091	0.214	+0.123	0.073
Common Grackle	+-+-+		1	-----	0.000	+-+-+	
Baltimore Oriole	+-+-+		1	-----	0.000	+-+-+	
ALL SPECIES POOLED	-0.178	+0.153	2	0.503	0.371	-0.132	0.063

Table 6. (cont.) Absolute changes between 2001 and 2002 in the PROPORTION OF YOUNG in the catch at two constant-effort MAPS stations on Naval Security Group Activity Sugar Grove.

Species	S. Fork Potomac R.	Beaver Creek	Both stations combined
No. species that increased	3	1	4
No. species that decreased	9	4	10
No. species remained same	2	1	1
TOTAL NUMBER OF SPECIES [5]	14	6	15
Proportion of increasing (decreasing) species	(0.643)	0.167	(0.667)
Sig. of increase (decrease)[6]	(0.212)	0.984	(0.151)

[1] Number of stations at which at least one aged bird was captured in either year.

[2] Standard error of the change in the proportion of young.

[3] The change in the proportion of young is undefined at this station because no aged individual of the species was captured in one of the two years.

[4] Proportion of young not given because no aged individual of the species was captured in the year shown.

[5] Species for which the change in the proportion of young is undefined are not included.

[6] Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species is not greater than 0.50.

*** P < 0.01; ** 0.01 ? P < 0.05; * 0.05 ? P < 0.10