North American Longevity Records for Nine Landbird Species Monitored at Yosemite National Park's MAPS Stations

***Erin Rowan*[1]**
***Rodney B. Siegel*[1*]**
***Danielle R. Kaschube*[1]**
***Sarah Stock*[2]**

[1]The Institute for Bird Populations
P.O. Box 1346
Point Reyes Station, CA 94956-1346

[2]Division of Resources Management and Science
Yosemite National Park
Yosemite Village, CA 95389

*Corresponding author
rsiegel@birdpop.org

ABSTRACT

Information on longevity of birds may provide insight into ecological pressures faced by particular species and populations and may also be useful in developing conservation approaches. However, longevity can be difficult to study in wild birds, and efforts to determine the ecological, evolutionary, behavioral and physiological factors that govern longevity of landbirds have been constrained by the quantity and quality of long-term monitoring data available. The Monitoring Avian Productivity and Survivorship (MAPS) program provides a framework that encourages the long-term operation of mark-recapture monitoring stations in North America, with more than 300 stations that have been operated for at least ten consecutive years since the program was established. Analysis of mark-recapture data from MAPS stations operated at Yosemite National Park between 1990-2013 yielded new North American longevity records for nine species: Red-breasted Sapsucker (Sphyrapicus ruber)*, Williamson Sapsucker* (Sphyrapicus thyroideus)*, White-headed Woodpecker* (Picoides albolavatus)*, Western Wood-Peewee* (Contopus sordidulus)*, Cassin's Vireo* (Vireo cassinii)*, Mountain Chickadee* (Poecile gambeli)*, Brown Creeper* (Certhia americana)*, Lincoln's Sparrow* (Melospiza lincolnii)*, and Cassin's Finch* (Haemorhous cassinii). *We suggest that the larger, continent-wide MAPS dataset likely contains a wealth of information for revealing patterns in avian longevity and the ecological factors, evolutionary constraints, and life history characteristics that may drive those patterns.*

INTRODUCTION

Longevity of organisms is likely regulated by many inter-related factors, including evolutionary history as well as more proximate constraints imposed by physiology, behavior, and genetics (Finch 1990, Holmes and Austad 1995, Harvey and Purvis 1999, de Magalhaes et al. 2007, Wasser and Sherman 2010). Despite the complex set of factors involved, information on longevity may provide insight into ecological pressures faced by particular species and populations, and may also be useful in developing conservation strategies (de Magalhaes and Costa 2009). Although longevity is an important component of the life history of organisms, it can be particularly difficult to study in wild, relatively long-lived vertebrates such as birds.

Summaries of maximum longevity records for landbirds in North America (Knappen 1928, Kennard 1975, Clapp et al. 1982, Clapp et al. 1983, Klimkiewicz et al. 1983, Klimkiewicz and Futcher 1987, Klimkiewicz and Futcher 1989) and efforts to describe patterns across species and attribute them to ecological correlates or life-history traits (Wasser and Sherman 2010) have necessarily been constrained by the amount and quality of long-term monitoring data available. In general, greater numbers of banded birds and more intensive efforts to recapture or re-sight those birds over a longer period of time are likely to yield longevity records that more closely approach the actual maximum longevity in the population under study (Clapp et al. 1982), while less robust monitoring efforts will, on average, yield longevity records that are further from the true maximum values within the population.

The Monitoring Avian Productivity and Survivorship Program (MAPS) program (DeSante et al. 2014), established in the early 1990s, provides a standardized protocol for constant-effort mist-netting of landbirds during the breeding season in North America, and a central repository for mark-recapture data collected using the protocol. The program was developed to facilitate monitoring of landbird vital rates such as survival, productivity and population growth rate, and to identify environmental causes of change in those vital rates (Nott et al. 2002, Saracco et al. 2009, Saracco et al. 2010). MAPS provides a framework that encourages the long-term operation of mark-recapture monitoring stations.

Some of the longest-running MAPS stations are within Yosemite National Park, located in the central Sierra Nevada of California, USA (Fig. 1). The park's MAPS stations were established during the 1990s (with the first station established in 1990) and subsequently operated every year since, yielding up to a 24-year run of continuous data from the park's relatively pristine meadow and forest ecosystems. Long-term monitoring data from protected areas like national parks are particularly valuable because they can serve as reference information for assessing the effects of regional land-use and land-cover changes on ecological processes outside the parks (Silsbee and Peterson 1991, Simons et al. 1999, Siegel et al. 2011).

We reviewed mark-recapture records from Yosemite's MAPS stations to assess maximum observed longevity for the landbird species monitored there. We compared the values we obtained with published summaries of landbird longevity records and with an on-line database of such records maintained by the United States Bird Banding Laboratory (Lutmerding and Love 2014). Here we report observed longevity values that represent new maximum records for North American landbird species.

METHODS

We examined mark-recapture records from five long-running MAPS stations at Yosemite National Park (Fig. 1). The stations were established in various years between 1990 and 1998 (Table 1) and each station was operated every year subsequent to establishment following standard MAPS protocol (DeSante et al. 2004, DeSante et al. 2014). Ten or 14 (Hodgdon Meadow only) fixed net sites were established within the central eight hectares of each station. For all stations except Hodgdon Meadow, nets were run on a single day within 5-8 ten-day periods between 21 May and 8 Aug. At Hodgdon Meadow, mist-netting was typically conducted across two days within each ten day period, with half of the 14 nets operated one day and the remaining nets operated on the second day. The maximum number of periods of operation at the highest-elevation stations, White Wolf and Gin Flat East Meadow, was seven due to later arrival of spring-like conditions and limited or no accessibility during the late spring.

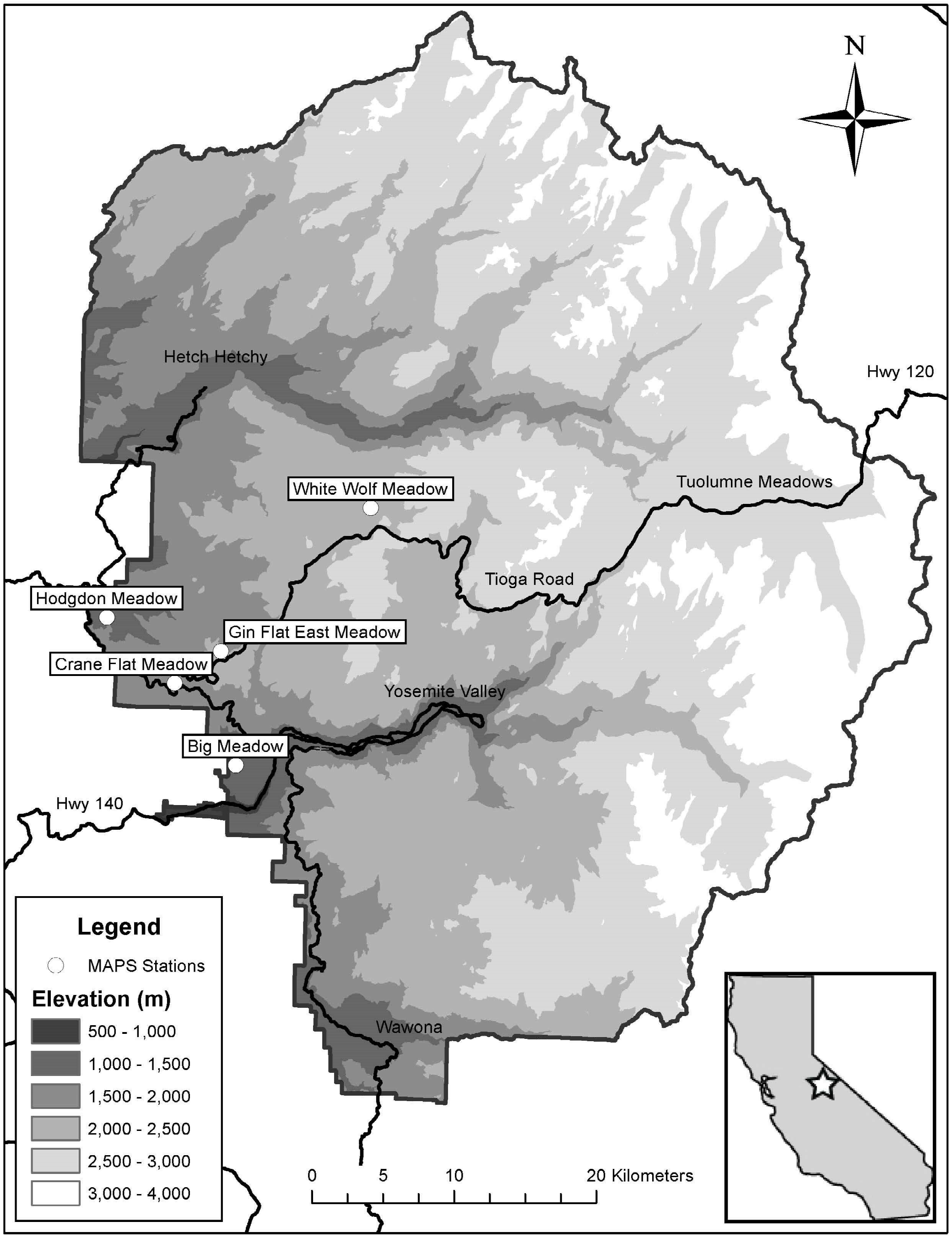
On each day of station operation, four-tier nylon mist-nets (12m x 2.5mm, 30mm mesh) were erected at each net site and were opened for approximately six hours beginning at local sunrise. Individual nets were occasionally closed due to inclement weather, unusually high capture rates that jeopardized the crews' ability to safely process all of the captured birds, or other logistical reasons. Nets were checked and birds extracted approximately every 40 minutes.

With few exceptions, birds captured at the stations were identified to species, age, and sex based on Pyle (1997), and previously unbanded birds were banded with numbered aluminum leg bands obtained from USGS Biological Resources Division. Band numbers of recaptured birds were carefully recorded.

The banding data were then entered electronically by John W. Shipman of Zoological Data Processing, Socorro, NM, proofed manually for entry errors and then run through a series of automated verification programs that checked for within- or between-record discrepancies. Any discrepancies or questionable data identified were examined individually and corrected if necessary.

The minimum ages of birds were calculated assuming a hatch date of 1 Jun, following protocol

Figure 1. Locations of five long-running MAPS stations in Yosemite National Park, California



established by Clapp et al. (1982), in combination with the inferred age of the bird at its original capture, and the number of years and months that passed between subsequent recaptures. One of the following ages was assigned to each bird upon its' original capture, as determined by breeding condition, skull ossification or plumage characteristics, outlined in Pyle (1997): Hatching Year (born within the calendar year and in juvenal plumage), Second Year (in its second calendar year and in formative plumage), After Second Year (in its third or greater calendar year and in basic plumage), and After Hatching Year (an adult, but unknown whether a Second Year or After Second Year in non-juvenal plumage). Recaptured birds were released healthy and alive; therefore, the longevity records we present represent the youngest possible age for the individuals considered.

Table 1. Year established, elevation, and habitat associated with five long-running Monitoring Avian Productivity and Survivorship (MAPS) Stations at Yosemite National Park, California.

Station	Year Established	Elevation (ft.)	Habitat
Big Meadow	1993	1,311	Riparian willows *(Salix* sp.) surrounded by montane meadow, Sierran mixed conifer forest, and montane chaparral.
Hodgdon Meadow	1990	1,408	Wet montane meadow with extensive willow and Mountain Dogwood (*Cornus nuttallii*) thickets, surrounded by Sierran mixed conifer forest.
Crane Flat Meadow	1993	1,875	Wet montane meadow with small willow thickets surrounded by Sierran mixed conifer and California Red Fir *(Abies magnifica*) forest.
Gin Flat East Meadow	1998	2,073	Wet meadow surrounded by Red Fir and Lodgepole Pine (P*inus contorta)* forest.
White Wolf Meadow	1993	2,402	Wet meadow surrounded by Red Fir and Lodgepole Pine forest.

Table 2. New North American maximum longevity records from the MAPS stations at Yosemite National Park.

Species	Band Number	Station	First Year Captured (age) [1]	Last Year Captured	Minimum Age at Last Capture [2]
Red-breasted Sapsucker (*Syphyrapicus ruber)*	1841-27360	Hodgdon Meadow	2009 (ASY)	2013	7 yr. 0 mo
Williamson's Sapsucker *(Sphyrapicus thyroideus)*	1681-48723	White Wolf Meadow	2000 (ASY)	2004	6 yr. 0 mo
White-headed Woodpecker (*Picoides albolavatus)*	1681-49403	Crane Flat Meadow	2001 (AHY)	2008	8 yr. 1 mo
Western Wood-Peewee *(Contopus sordidulus)*	2320-07501	Hodgdon Meadow	2004 (AHY)	2011	8 yr. 1 mo.
Cassin's Vireo *(Vireo cassinii*)	1851-20312	Hodgdon Meadow	2004 (AHY)	2011	8 yr. 1 mo.
Mountain Chickadee *(Poecile gambeli)*	2320-07215	Crane Flat Meadow	2003 (ASY)	2011	10 yr. 1 mo.
Brown Creeper (*Certhia americana)*	2330-94553	Gin Flat East Meadow	2006 (AHY)	2011	6 yr. 1 mo.
Lincoln's Sparrow (*Melospiza lincolnii)*	2121-55897	Crane Flat Meadow	1993 (HY)	2002	8 yr. 11 mo.
Cassin's Finch *(Haemorhous cassinii)*	1531-57414	White Wolf Meadow	1997 (ASY)	2003	8 yr. 0 mo.

[1] HY=Hatching Year (hatched within the calendar year); ASY=After Second Year (in its third or greater calendar year); AHY=After Hatching Year (adult, unknown between Second Year and After Second Year).

[2] Ages are minimums, as all birds were released alive at the time of their last capture.

RESULTS

Between 1990 and 2013, 39,654 birds were banded at the Yosemite MAPS stations and 2,001 of those were recaptured in at least one subsequent year. The mark-release-recapture data for these birds yielded longevity records (Table 2) for seven species that exceed maximum values for North America published previously or posted online (http://www.pwrc.usgs.gov/BBl/longevity/longevity_main.cfm last updated Jun 2014) by the USGS Bird Banding Laboratory: Red-breasted Sapsucker (*Sphyrapicus ruber*), White-headed Woodpecker (*Picoides albolavatus*), Western Wood-Peewee (*Contopus sordidulus*), Mountain Chickadee (*Poecile gambeli*), Brown Creeper (*Certhia americana*), Lincoln's Sparrow (*Melospiza lincolnii*), and Cassin's Finch (*Haemorhous cassinii*). Additionally, we were unable to find any previously published maximum longevity records for Williamson's Sapsucker (*Sphyrapicus thyroideus*) or Cassin's Vireo (*Vireo cassinii*), so our maximum values for those two species (6 years, 0 months and 8 years, 1 month, respectively) are also included in Table 2, yielding new North American maximum longevity records for nine species.

DISCUSSION

Despite their high metabolism, high body temperatures, and high blood glucose levels, all of which are associated with rapid aging in most vertebrates (Holmes and Austad 1995), birds show very little physical evidence of senescence and, as a group, are relatively long-lived for their body size when compared with mammals (Holmes and Austad 1995, Munshi-South and Wilkinson 2010). While birds' cell resistance to oxidation and aging is not permanent, most bird deaths appear to be due to disease, starvation, accidents, or predation rather than simply age (Harrison 1990, Vleck et al. 2007, Ogburn et al. 2001). Understanding landbird senescence and mortality patterns has historically been constrained by the rather limited information available on maximum longevity for most species (Wasser and Sherman 2010, Holmes and Austad 1995).

The maturing of the MAPS program means that data on longevity of wild birds are becoming increasingly more abundant. Fewer than 10% of banded birds (based on all banding records, not just records from the MAPS program) are ever recaptured, collected, or found dead (Harrison 1990), indicating that extensive, sustained bird-banding efforts are needed to describe robustly longevity patterns in landbirds. Since the MAPS program was established in the early 1990s, well over 300 MAPS stations have operated for at least ten consecutive years, producing the kind of long-term mark-release-recapture data necessary for meaningfully assessing longevity in a large number of landbird species. Here we provide longevity records from a cluster of MAPS stations in one national park. It is unclear whether the substantial number of new longevity records obtained from the Yosemite data reflects particularly high longevity at Yosemite, perhaps due to the relatively pristine condition of the habitat, or whether similar numbers of new maximum longevity records can be expected from other long-running MAPS stations across North America. Either way, the larger, continent-wide MAPS dataset likely contains a wealth of information for advancing our understanding of patterns in avian longevity, and the myriad ecological factors, evolutionary constraints, and life-history characteristics that may drive them.

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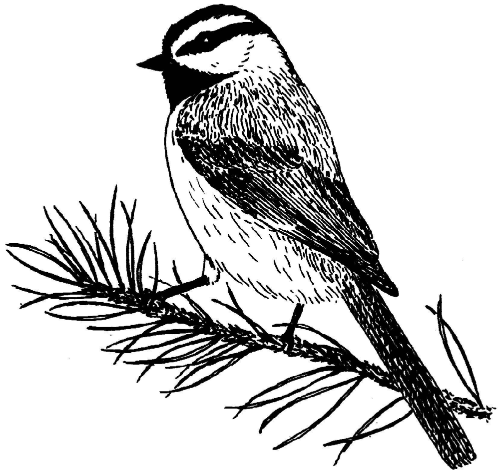

Mountain Chickadee
by George West

Brown Creeper
by George West