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Population Dynamics of Ten Avian Species Breeding at Lucky Peak, Boise Foothills, Idaho

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2nd Place Winner of the 2010 Student Choice Award.

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Abstract

Long term projects like the Idaho Bird Observatory's Lucky Peak banding station provide valuable information on bird conservation and life history traits. We explored banding data from 1997-2009 to examine yearly patterns of abundance and survivorship for the 10 most common breeding species. We found that survivorship patterns vary by species. We documented Nashville and Yellow warblers living up to 4 years, while some Dusky Flycatchers, MacGillivray's Warblers and Chipping Sparrows lived 7 years or more. In fact several Western Tanagers and Dusky Flycatchers exceed or match longevity records in the USGS Bird Banding Lab database. The ratio of hatch year birds (hatched that spring) to adults lends insight into survivorship, productivity and recruitment in the community. Species may have low numbers of hatch years one year yet high numbers of second year birds (hatched the previous spring) the next year. This was particularly seen in Warbling Vireos and suggests that immigration is important for this species. In contrast, the number of hatch year Spotted Towhees in one year correlated with the number of second years in the next year, implying that many towhees hatched at the site return to breed. Analysis also showed trends in population dynamics and striking annual difference in species' abundance. Neotropical migrants like MacGillivray's and Yellow warblers peaked in both 2000/01 and 2006/07 but Nashville Warblers (another Neotropical species) peaked in 2005. Interestingly, short distant migrants such as Chipping Sparrow and Spotted Towhee also peaked in 2005. Further investigation is required to determine which factors—possibly including weather, diet, timing of breeding and migration strategy—contribute to these fluctuations.

Comments

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ABSTRACT

We explored capture and banding data from 1997-2009 at the Idaho Bird Observatory's Lucky Peak banding station to examine patterns of abundance and survivorship for the ten most frequently-captured breeding bird species, including how these patterns vary by year. We found that survivorship patterns vary by species. We documented Nashville and Yellow warblers surviving up to four years whereas multiple individuals of Dusky Flycatcher, MacGillivray's Warbler, and Chipping Sparrow lived seven years or more. In fact, several Western Tanagers and Dusky Flycatchers exceed or match longevity records according to the USGS Bird Banding Lab's database.

The ratio of hatch-year birds (0 years old) to adult birds (1+ year old) lends insight into survivorship, productivity, and recruitment within Lucky Peak's breeding bird community. The ratios observed in Warbling Vireos and other species suggests that immigration is important for maintaining their breeding populations at Lucky Peak. In contrast, ratios for other species implied that many individuals that are hatched at the site return to breed.

Our analysis also revealed trends in population dynamics and striking annual differences in species' abundance. Neotropical migrant warblers such as MacGillivray's Warbler and Yellow Warbler peaked in both 2001 and 2007. Interestingly, short-distant migrant sparrows such as Chipping Sparrow and Spotted Towhee peaked in 2004.

Preliminary investigations into weather trends showed some meaningful correlations for the species analyzed. Precipitation and temperatures from Boise, ID (breeding grounds) and Guadalajara, Mexico (approximate wintering grounds for Neotropical migrants) were correlated to yearly population changes for some species. MacGillivray's Warbler populations are known to winter in Mexico near Guadalajara and were influenced by winter precipitation whereas Audubon's Warbler and Warbling Vireo year to year numbers were influenced more by springtime temperature and precipitation in Boise.



INTRODUCTION

Goals of study:

- Explore variables that effect populations of passerine bird species breeding at Lucky Peak near Boise, ID

Many variables cause animal populations to fluctuate annually, including:

- habitat change
- changes in predator-prey interactions
- weather
- disease

This study explored population changes caused by:

- life history traits
 - diet – seeds versus insects
 - migratory strategies– distance, location, timing
- weather
 - breeding grounds (Boise)
 - wintering grounds (Guadalajara)



- Use recapture data to determine longevity

- Analyze weather data from breeding (Boise) and wintering grounds (Guadalajara) to determine its affects on population

- Compare differences in species' diet and migratory strategy to explain population trends.

- Use age ratios of Hatch Year (0 year old) and Second Year (1 year old) birds to infer survivorship and recruitment

Hypotheses:

- Species with few young produced locally must rely on immigration to maintain populations
- Species with different diets or migration strategies will differ in their patterns of variation in annual success

- Weather may be a significant cause of the observed population fluctuations

METHODS

- Utilized 13 years of data from Lucky Peak for the 10 most common breeding species
- Calculated minimum possible age for longevity data
- Population abundance calculated
- Regression analysis used to correlate population and weather trends for 2000-2009
- airport temperature and precipitation data used for weather analysis
 - regression analysis of Boise data performed for:
 - Audubon's Warblers, Warbling Vireos, Dusky Flycatchers
 - analysis of Guadalajara data done for:
 - MacGillivray's Warblers, Warbling Vireos, Dusky Flycatchers

RESULTS

Species listed in order of abundance

- (n=total individuals captured during the 2000-2009 breeding seasons)
- Dusky Flycatcher (n=1,805)
 - MacGillivray's Warbler (n=1,736)
 - Chipping Sparrow (n=1,115)
 - Yellow Warbler (n=1,035)
 - Nashville Warbler (n=1,006)
 - Audubon's Warbler (n=976)
 - Spotted Towhee (n=763)
 - Warbling Vireo (n=713)
 - Western Tanager (n=625)
 - Lazuli Bunting (n=564)

Age ratios

- Many second year (SY; 1 yr old) 'adult' birds and few locally-produced hatch year (HY; 0 yr old) birds in populations of:
 - Warbling Vireo (Figure 1)
 - Western Tanager
 - Dusky Flycatcher
- Other species populations had equal proportions of HY & SY birds

Life Histories (Figure 2)

- Chipping Sparrows and Spotted Towhees:
 - populations *peak* near 2004
- Yellow and MacGillivray's Warblers:
 - populations *peak* near 2001 and 2007
 - populations *decrease* in 2004

Longevity

- Maximum age for individuals:
 - range: 4 to 10 years
 - most species: 6 or 7 years
- Several species matched or exceeded age records:
 - Dusky Flycatcher:
 - BBL (Bird Banding Lab) record: 8 years
 - Lucky Peak records: one age 10, one age 9
 - Western Tanager:
 - BBL and Lucky Peak record: 6 years.
- Some species were well below BBL records:
 - Yellow and Nashville Warblers:
 - BBL record: 10 years
 - Lucky Peak record: 4 years

Weather

Boise weather has significant impacts on populations.

- Springtime temperatures and precipitation influenced:
 - Audubon's Warblers (Figure 3)
 - greater June rainfall = higher #s of HY birds
 - Warbling Vireos (Figure 4)
- warmer average spring temp = higher numbers of total birds

- Guadalajara weather had impacts on MacGillivray's Warbler populations (Figure 5).
- more February precipitation = higher numbers of MacGillivray's Warblers

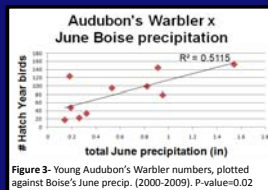


Figure 3- Young Audubon's Warbler numbers, plotted against Boise's June prec. (2000-2009). P-value=0.02

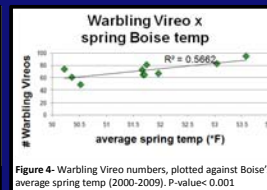


Figure 4- Warbling Vireo numbers, plotted against Boise's average spring temp (2000-2009). P-value<0.001

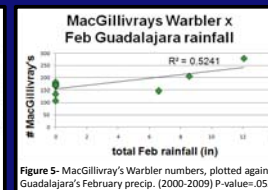


Figure 5- MacGillivray's Warbler numbers, plotted against Guadalajara's February prec. (2000-2009) P-value=.053

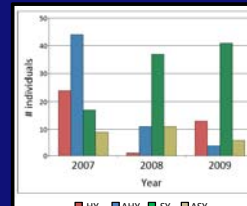


Figure 1- Warbling Vireo populations from 2007-2009 separated by age: hatch year (red), after hatch year (blue), second year (green), and after second year (tan). Plotted by year (x-axis) and # individuals (y-axis)

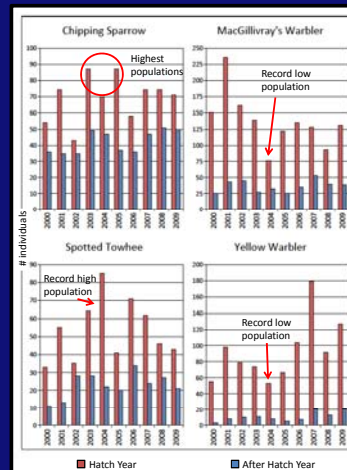


Figure 2- Four species with varying life-history traits plotted by year (x-axis) and number of individuals (y-axis). Separated by age: hatch year (red) and after hatch year (blue). From 2000-2009

PRELIMINARY CONCLUSIONS

Age ratios (Figure 1)

- Few HY birds in one year and more SY birds the following year strongly suggests:
 - not all SY birds were hatched at Lucky Peak
 - recruitment (immigration of new individuals into a population) is important for these species
 - adult population is not sustained by young produced at the site
- Other species show fewer SY birds relative to HY's the following year which suggests:
 - the population does not have high recruitment
 - many birds hatched at Lucky Peak likely return as adults

Life Histories

- Chipping Sparrows and Spotted Towhees are similar:
 - in the sparrow family *Emberizidae*
 - rely primarily on seeds in winter
 - winter in Texas and N. Mexico (Figure 6)
- MacGillivray's and Yellow Warblers are similar:
 - in the warbler family *Parulidae*
 - feed primarily on insects throughout the year
 - Neotropical migrants: winter in W. & S. Mexico (Figure 7)

Diet Hypothesis

- 2004: good year for seeds?
- 2001 and 2007: good years for insects?

Migration Hypothesis

- arrival and breeding times differ because of distance traveled
- wintering locations or migration routes had different:
 - weather
 - habitat changes
 - food supplies

True cause is unknown!

Longevity

Multiple species studied did not match the BBL longevity data

- Dusky Flycatchers *exceeded* BBL records:
 - Why?
 - more multi-year recaptures. Increased odds because:
 - Dusky's may survive longer at Lucky Peak *and/or*
 - higher site fidelity here than at other locations
- Yellow and Nashville Warblers were *below* BBL records
 - Why?
 - Lucky Peak breeders have lower survivorship *and/or*
 - not enough recaptures to show true age distribution

Weather

Warmer temps and more rainfall in Boise increased population numbers for all species examined.

- Springtime temps (Figure 4) may influence:
 - arrival timing of adults
 - nesting success
 - food supplies
- Rainfall in June (Figure 3) could influence:
 - amount of food available to young birds
 - June is an important month for nesting and fledging
- More rainfall in Guadalajara increased numbers of MacGillivray's Warblers.
- Correlation supports idea that Guadalajara is near actual wintering grounds (or an area with similar climate) for the Lucky Peak population (Figure 5)
- February precipitation may mean:
 - good weather in general
 - improved food supplies:
 - increased fitness of adults prior to migration
 - more likely to survive migration journey
 - more fit for reproduction once they arrive

Similar conclusions were also reached by Nott et al. 2002¹

Special thanks to:

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- The Idaho Bird Observatory and all crews from '97-'09 who contributed to the data set



Figure 6- Spotted Towhee Breeding (blue), Year-round (green) and Wintering (orange) ranges. Boise indicated by arrow.



Figure 7- MacGillivray's Warbler Breeding (blue) and Wintering (orange) ranges. Guadalajara and Boise indicated.



MacGillivray's Warbler. Stephanie Coates

1. Nott, M.P., D.F. Desante, R.B. Siegel and P. Pyle. 2002. Influences of the El Niño/Southern Oscillation and the North Atlantic Oscillation on avian productivity in forests of the Pacific Northwest of North America. *Global Ecology & Biogeography* 11: 333-342

Range maps from Cornell Lab of Ornithology: Birds of North America Online