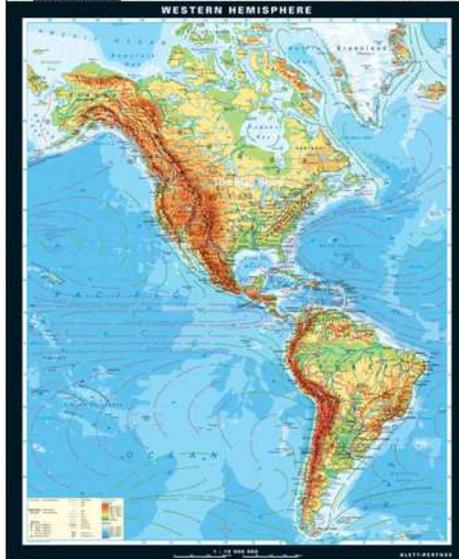


Demographic models and population bottlenecks of Cerulean and Golden-winged Warblers



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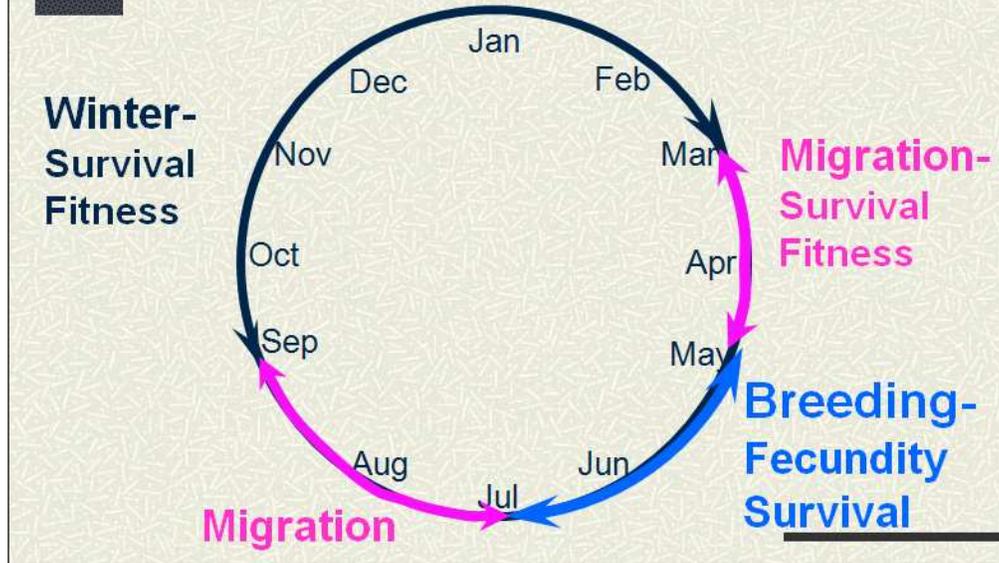
Today.....

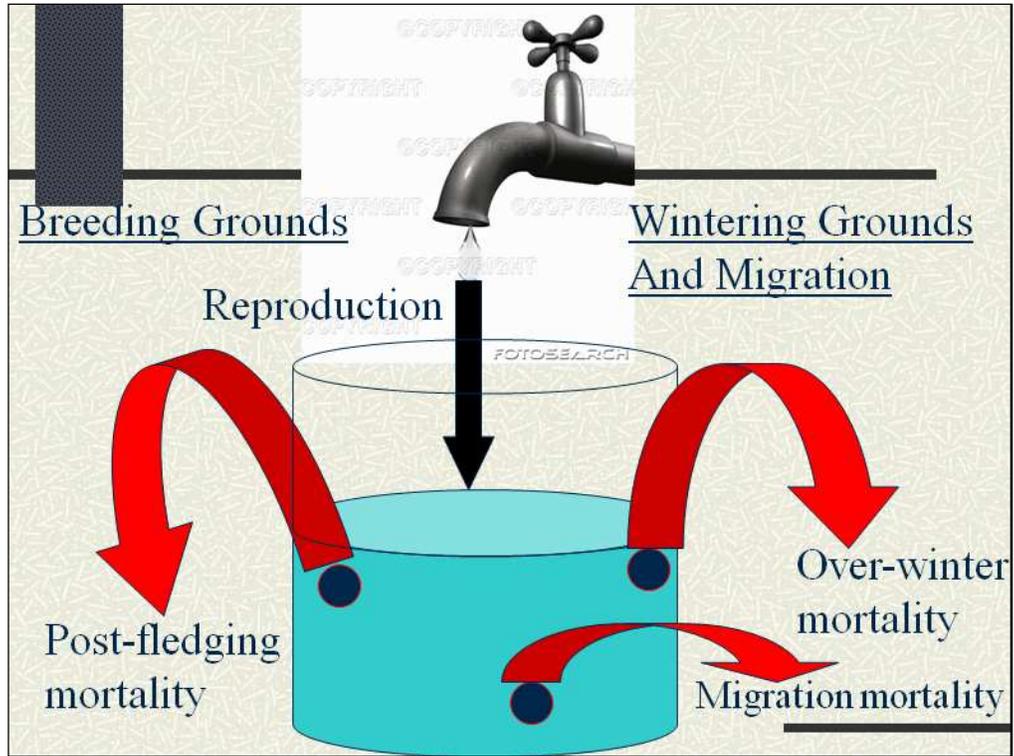
- ▣ Present data on Golden-winged Warbler and Cerulean Warbler fecundity and survival to isolate the demographic reasons for population declines.
 - ▣ Discuss implications for where and how these populations are being limited.
 - ▣ Discuss data limitations.
-

These are not easy questions to answer...

- because there is variation in patterns by
 - Species
 - Year
 - Geographically across range
 - Habitat type
 - **But this knowledge is fundamental to development of our conservation strategies!!!**
-

Consider the migrant life cycle





Life History Strategy Makes A Difference in Conservation Strategy

← Increasing importance of reproduction

← Increasing importance of survival →

<u>Northern Bobwhite</u>	<u>Grassland Sparrows</u>	<u>CERW & GWWA</u>
•Multiple broods	•Multiple broods	•Single brood
•Clutch size >10	•Clutch size > 4	•Clutch size 4-5
•Modest nest success	•Modest nest success	•Good nest success
•Poor survival	•Moderate survival	•Good survival
•2x popn in 1 year	•Somewhat limited capacity to increase	•Very limited capacity to increase?
•Do not migrate	•Short distance migrants	•Neotropical migrants

Rappole and McDonald (1994)

Cause and effect in population declines in migratory birds. *Auk* 111:652-660.

- # **“Fourteen predictions have been made based on the hypothesis that Nearctic migrant population declines have occurred as a result of changes to breeding-habitat amount or quality. Examination of these predictions based on the literature does not support the hypothesis. Alteration of wintering-ground habitat provides the most parsimonious explanation for the observed demographic characteristics”.**
-

Since Rappole and McDonald (1994)

- ‡ Numerous authors have considered this question on a variety of Neotropical migrants with varying results.
 - ‡ Review of these studies suggest that all stages of the life cycle may affect populations but some stages (e.g., migration) may be more significant than others.
-

Cerulean Warbler data



Data on reproduction

- Tennessee 1997-98, 2005-06
- Ontario 1994-2002
- Indiana 2002-05
- Michigan 2002-06 (two sites)
- Mississippi Alluvial Valley 1992-2005 (3 sites)

Data on survival

- Annual ♂ survival (Jones et al. 2002)

Golden-winged Warbler data



- # Data on reproduction and minimum survival
 - Ontario 2001-05
 - Queen's University Biological Station
 - Tennessee 2003-06
 - Cumberland Mountains – 2 Wildlife Management Areas

- # Estimates of annual ♀ survival and daily nest survival rates from Program MARK

Data Analysis

▣ Parameter estimation - Program MARK

- Daily nest survival
 - Temporal factors
 - year, time (linear and quadratic), nest age, nest stage
 - Climatic factors
 - daily precipitation, minimum daily temperature
- Annual adult survival and recapture probability
 - Phi (Φ) and p
 - Cormack-Jolly-Seber model
 - sex, year, and sex*year interactions

Same models for daily nest survival as described in objective 1, but no habitat factors

Annual survival – year and sex effects – would have been nice to estimate effects of age and/or hybridization, but this was not possible. We had a very small sample of hybrid birds banded (< 10) and despite the fact that we banded >100 nestlings each year, less than 10% returned and these birds were often difficult to detect as they dispersed to other nearby sites.

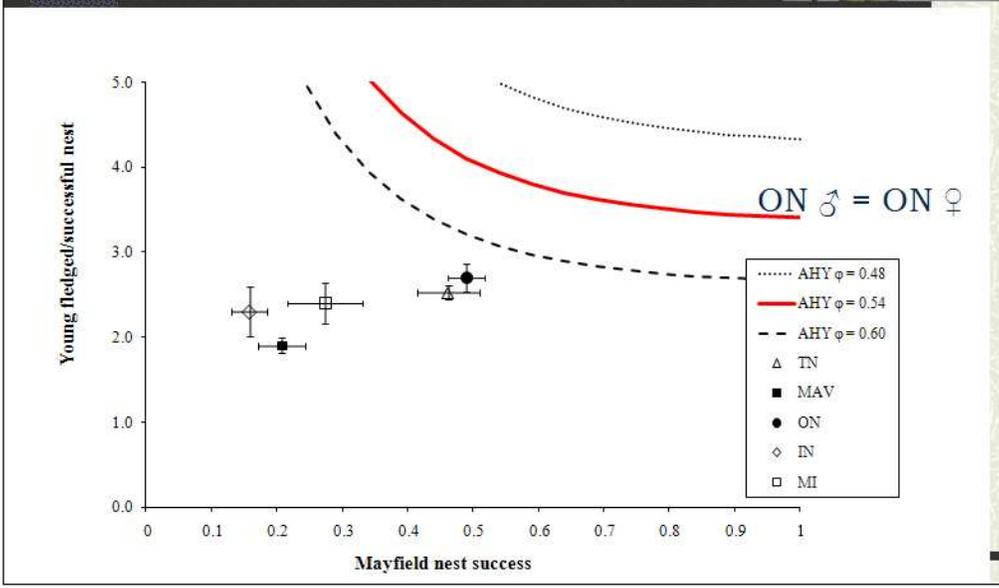
Data Analysis

- Population projection - PopTools
 - Two-stage Leslie matrix - estimate lambda (λ)
 - Model averaged estimates

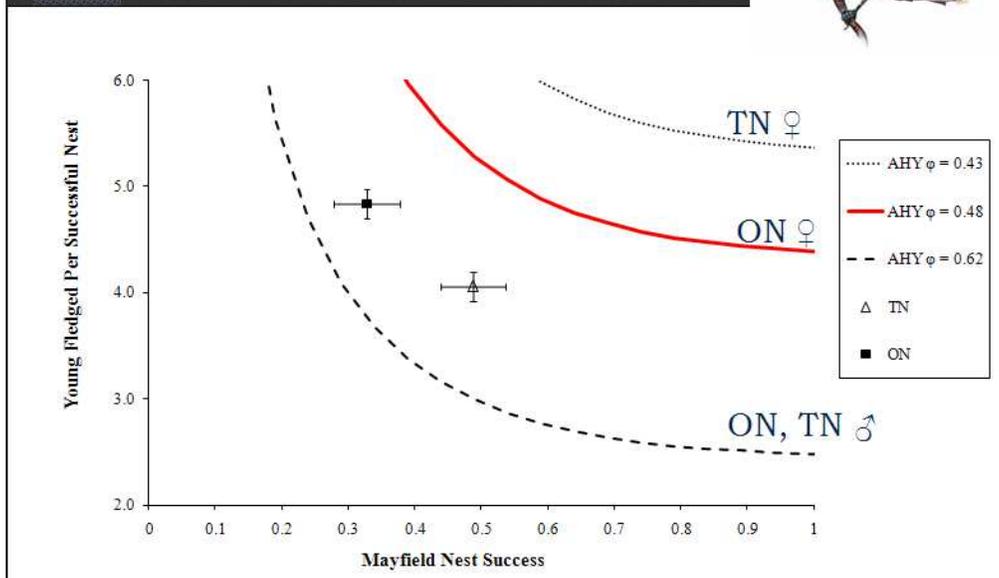
SY = Second year
ASY = After second year

SY fecundity	ASY fecundity
SY survival	ASY survival

CERW Population Growth (λ)



GWWA Population Growth (λ)



Elasticity Analysis



Elasticity = proportional change in λ given a prop. change in a matrix element while all other elements remain constant.

SY fecundity

ASY fecundity

SY survival

ASY survival

Ontario

0.1548	0.2386
0.2386	0.3677

Tennessee

0.1893	0.2457
0.2457	0.3190

Elasticities can be added to obtain combined effects of multiple changes in vital rates (i.e. the net effect on λ). Often the vital rate with the highest elasticity value is recommended for management, BUT

Elasticity values should always be interpreted prospectively (not retrospectively) and with caution due to the uncertainty in vital rate estimates, and the fact that the effects of environmental stochasticity and density dependence are not incorporated. Should be considered first steps in a wider framework of modeling and hypothesis testing

Elasticity analysis



MAV

0.0822 0.2045
0.2045 0.5087

Indiana

0.0784 0.2016
0.2016 0.5184

Michigan

0.0691 0.1938
0.1938 0.5434

Ontario

0.1619 0.2404
0.2404 0.3571

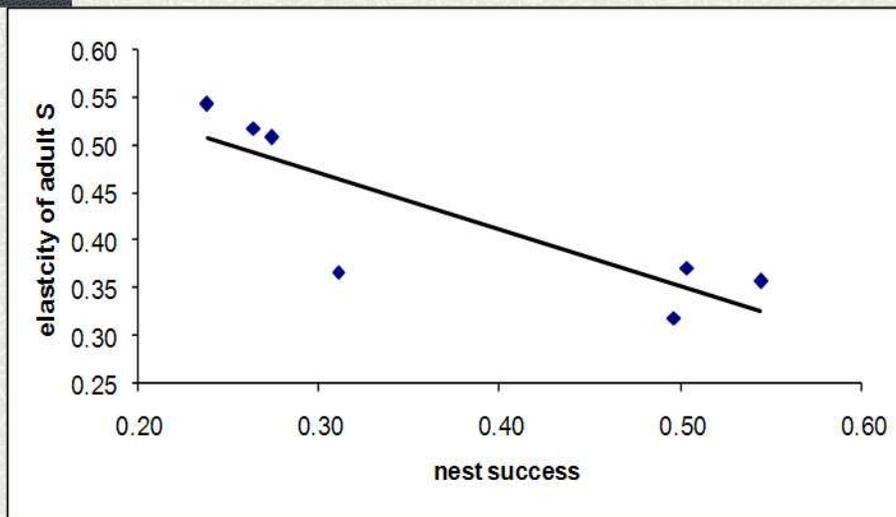
Tennessee

0.1523 0.2379
0.2379 0.3717

Qualitative ranking of elasticities does not change for all populations, but importance of adult survival does.

These elasticities especially should be interpreted with caution b/c the estimates of survival are “best guesses”

When nest success is high,
adult survival does not affect λ as much



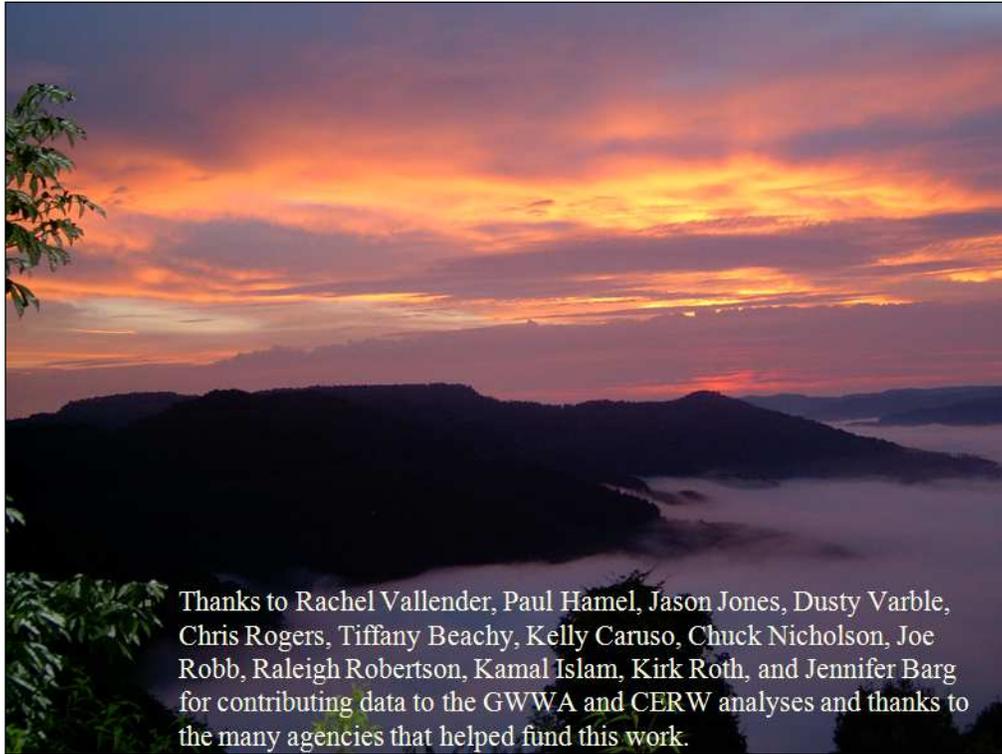
Linkages-

Fitness Affects Survival and Reproduction



Data Limitations

- We need better data on
 - Female CERW survival
 - AD dispersal rates (CERW and GWWA)
 - Post-fledging survival (CERW and GWWA)
 - Over-winter survival (CERW and GWWA)
-



Thanks to Rachel Vallender, Paul Hamel, Jason Jones, Dusty Varble, Chris Rogers, Tiffany Beachy, Kelly Caruso, Chuck Nicholson, Joe Robb, Raleigh Robertson, Kamal Islam, Kirk Roth, and Jennifer Barg for contributing data to the GWWA and CERW analyses and thanks to the many agencies that helped fund this work.