

# Cerulean Warbler

## Migration stopover ecology

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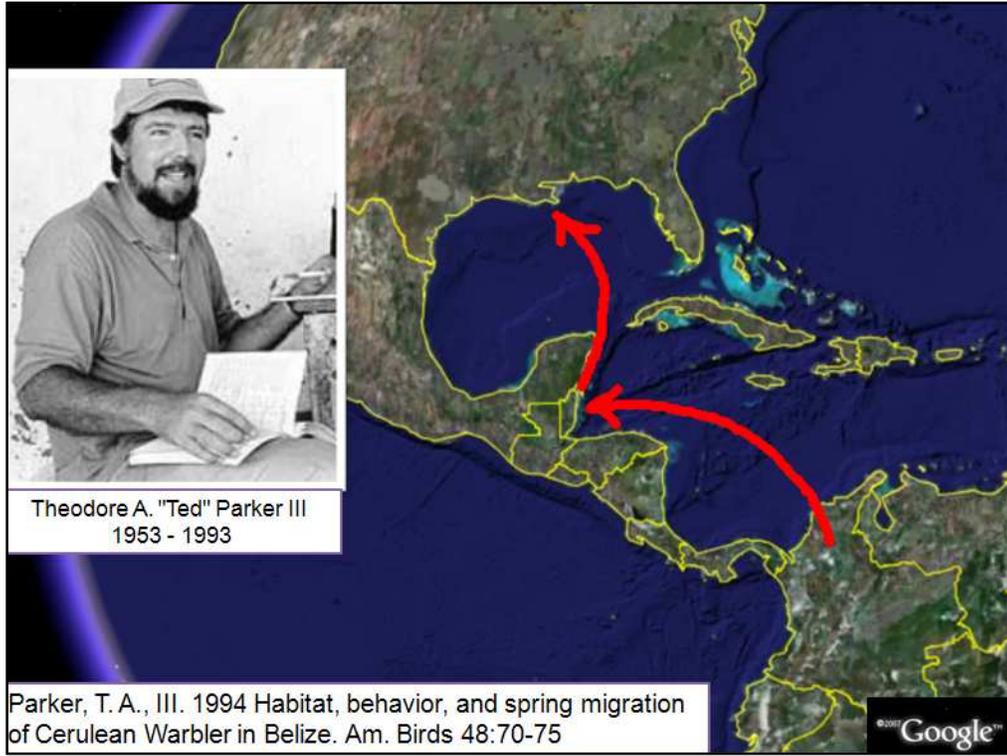
## Importance of migration ecology

- Up to 89% of annual mortality may occur during migration (Sillett and Holmes 2002)
- As much as a third of the annual cycle is spent in migration
- Conservation requires meeting species needs during breeding, winter, and throughout migration



Theodore A. "Ted" Parker III  
1953 - 1993

Parker, T. A., III. 1994 Habitat, behavior, and spring migration  
of Cerulean Warbler in Belize. *Am. Birds* 48:70-75



## 2004 Belize Expedition



Cerulean Warblers were the most common migrant observed



## Project Goals

- Asses timing, habitat associations, and distribution of Ceruleans during spring migration
- Create awareness of the Cerulean status and enthusiasm for its conservation in Central America.
- Develop a predictive model for Cerulean Warbler stopover occurrence.

# Survey locations 2005 & 2006

Sites of historic records

- Areas that conformed to Parker's 1994 hypothesis: low montane wet forests on Caribbean-facing slopes

Honduras and Guatemala

	Teams	Biologists	Surveys
2005	4	12	32
2006	5	21	47

## Survey locations 2007

- Areas predicted by the Cerulean Warbler stopover habitat model

Honduras, Guatemala, Chiapas, Mexico

	Teams	Biologists	Surveys
2007	6	21	90

# Workshops



With the assistance of David Anderson, PhD candidate at LSU, and Selvin Perez, and several Honduran and Guatemala biologists

## Survey methods

- Four to six teams conducted simultaneous surveys between March 25 and April 22 in 2005 – 2007.

A survey team consisted of from one to four resident or foreign biologists, and a local guide.



## Survey methods cont.

- Line transects
  - 0.5 to 3.5 km in length
  - 0.5 to 5.5 hours after sunrise
  - primary and secondary moist broadleaf forest, and rustic shade coffee plantations.
  - elevations from 19m to 1440m.



## Survey methods cont.

- Species composition recorded for each flock encountered.
- Additional data was collected for Cerulean Warblers.
- Playback was used to increase possible Cerulean detections.



# Results

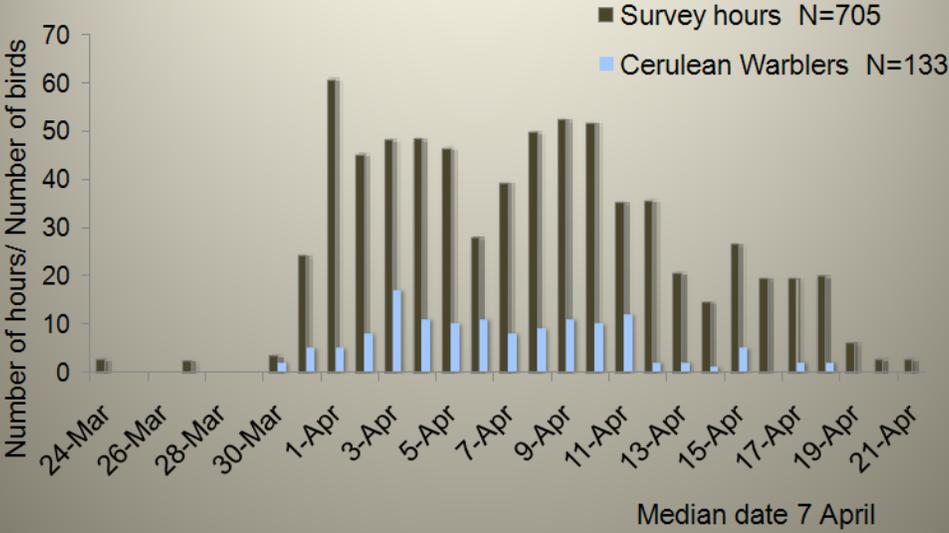


Country	Total surveys conducted	Hours of surveys	CERW observed
Belize	9	31.5	16
Honduras	79	316.5	36
Guatemala	70	304.5	65
Mexico	19	61.5	16
<b>Total</b>	<b>177</b>	<b>714</b>	<b>133</b>

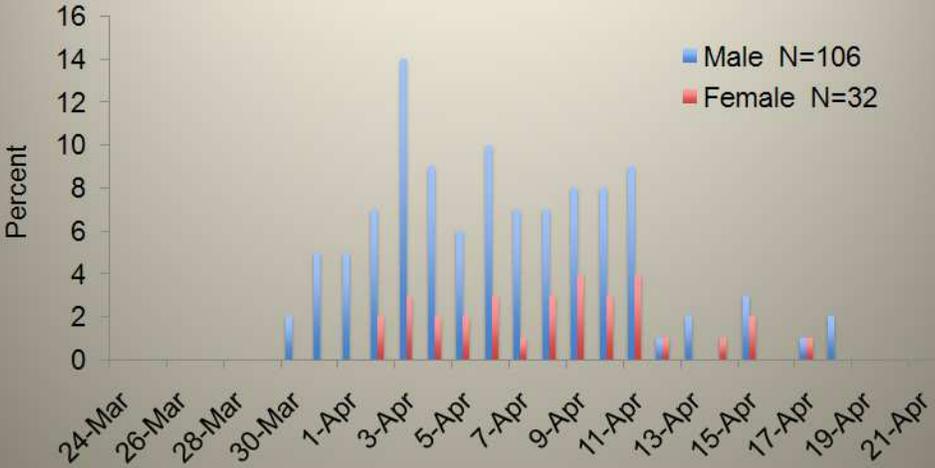
8 Additional CERW observed ad hoc

106 Male  
34 Female  
1 Unk

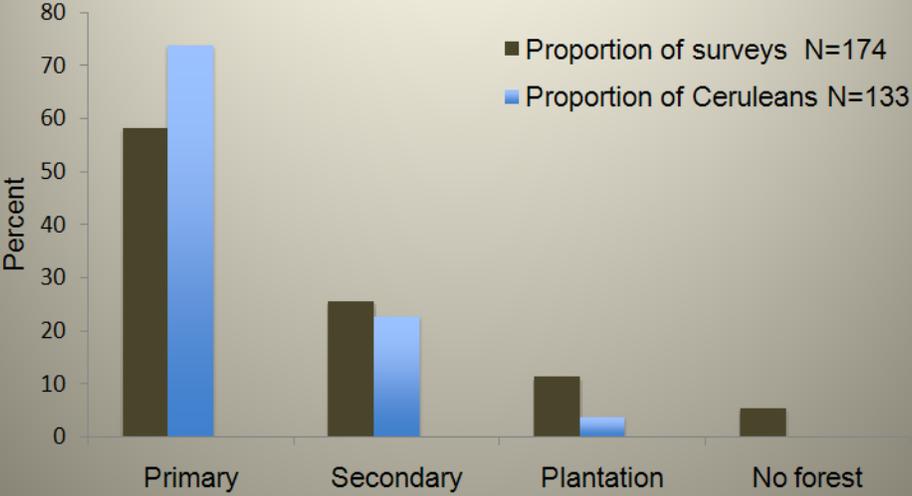
# Timing of migration



# Timing of migration



# Habitat



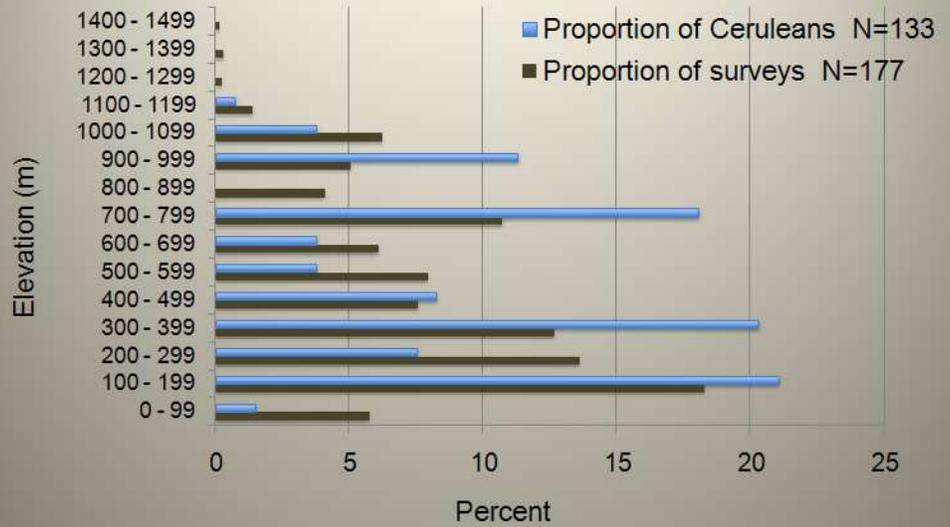
# Habitat use

Ceruleans found in tall mid-story trees

	Average	SD
"Foraging" height (m)	14.9	6.51
Tree height	22.0	8.23
Canopy height	24.5	5.78
Emergent trees	31.8	6.69



# Elevation



Average 488m (SD=298.3)

# Flock associates 2007



Common Name	Scientific Name	% of flocks
Lesser Greenlet	<i>Hylophilus decurtatus</i>	77%
American Redstart	<i>Setophaga ruticilla</i>	52%
Magnolia Warbler	<i>Dendroica magnolia</i>	47%
Tennessee Warbler	<i>Vermivora peregrina</i>	43%
Black-throated Green Warbler	<i>Dendroica virens</i>	43%
Red-eyed Vireo	<i>Vireo olivaceus</i>	37%
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	37%
Black-and-white Warbler	<i>Mniotilta varia</i>	37%
Wilson's Warbler	<i>Wilsonia pusilla</i>	27%
Blackburnian Warbler	<i>Dendroica fusca</i>	23%

167 total flocks; 31 with Cerulean Warblers  
48 different native species; 21 Neotropical migrants



## Ceruleans per flock



	<b>1 CERW</b>	<b>2 CERW</b>	<b>3 CERW</b>	<b>4 CERW</b>	<b>5 CERW</b>	<b>Total CERW</b>
Belize	3	2	0	1	1	16
Honduras	12	12	7	2	0	65
Guatemala	21	5	0	0	1	36
Mexico	10	3	0	0	0	16
<b>Total flocks</b>	<b>46</b>	<b>22</b>	<b>7</b>	<b>3</b>	<b>2</b>	
<b>% CERW</b>	<b>34.6%</b>	<b>33%</b>	<b>16%</b>	<b>9%</b>	<b>7.5%</b>	<b>N=133</b>

# Response to playback



Country	CD used	Male	Female	Responded to CD	Male	Female
Belize	16	13	3	5	4	1
Honduras	21	16	5	4	3	1
Guatemala	29	21	8	4	2	2
Mexico	16	11	5	10	8	2
<b>Total</b>	<b>82</b>	<b>61</b>	<b>21</b>	<b>23 (28%)</b>	<b>17</b>	<b>6</b>

16 CERW (12 males, 4 females) May not have been detected without CD

Plus 2 more females that responded to males responding to playback

# Vocalization

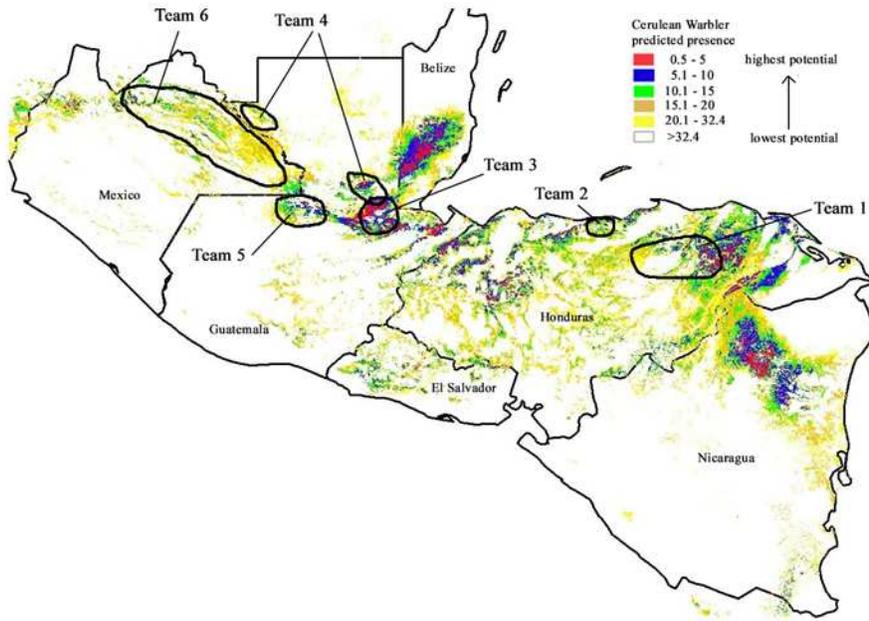


Country	Total CERW	Sang	Sang in response to CD	Singing spontaneously
Belize	16	1	1	0
Honduras	36	3	1	2
Guatemala	65	9	0	9
Mexico	16	3	1	2
<b>Total</b>	<b>133</b>	<b>16</b>	<b>3</b>	<b>13</b>

# Encounter frequency



# Model output and 2007 survey regions



## Mahalanobis distance ( $D^2$ ) habitat model explanatory variables

1. Elevation
2. Average solar exposure
3. Mean temperature for April
4. Mean precipitation for April
5. Precipitation for the wettest quarter
6. Temperature for the driest quarter
7. Tree canopy cover

these 7 explanatory variables were selected from the 19 bioclimatic variables available for the study area

Using the 94 CERW locations, recorded between 2004 – 2006, these 7 variables

We extract values for these variables for each of the 94 CERW location to determine the “idea” CERW location (at the level of a pixel = 1 km<sup>2</sup>)

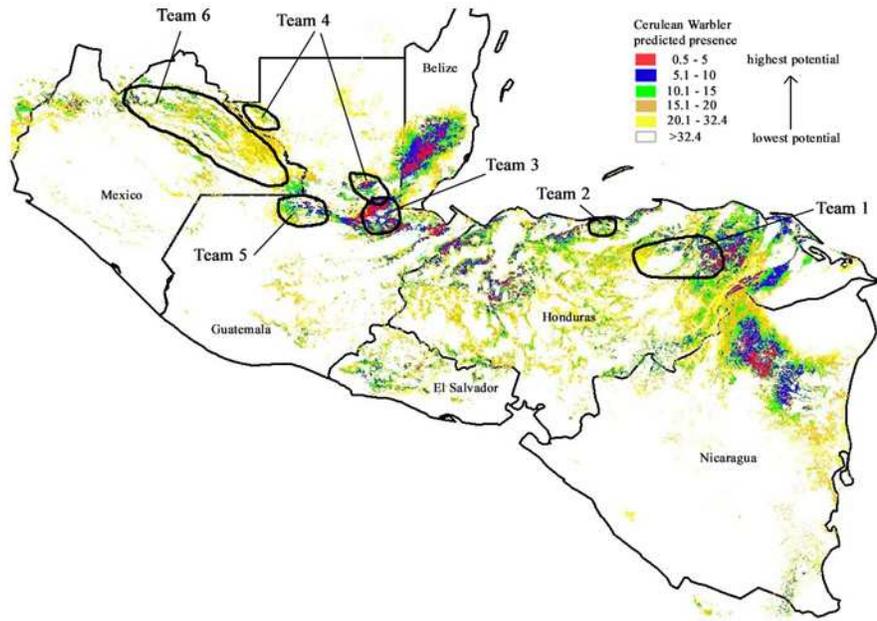
Compared the idea CERW location to all possible locations in the study area (defined at Chiapas, Mexico to Nicaragua)

Using the 94 CERW location collected between 2004 and 2006 and these 7 explanatory variables we could extract a value for the “ideal” CERW location at the level of a 1x1km pixel. That pixel could then be compared with all pixels in the study area and a map of potential CERW stopover habitat is generated

## Model development

- Extract values for the 7 variables for each Cerulean Warbler location (N=94)
- Compare the “ideal” Cerulean location with all locations in the study area
- Validate model using points collected in 2007

# Model output and 2007 survey regions



## Model performance

- 22 of the 23 transects where Ceruleans were located were correctly classified (95.8% sensitivity)
- The proportion of correctly predicted absences could not be calculated

Both because we did not specifically sample areas that the model predicted that CERW should be absent and  
Because it is difficult to confirm an absence for a migratory bird in stopover habitat

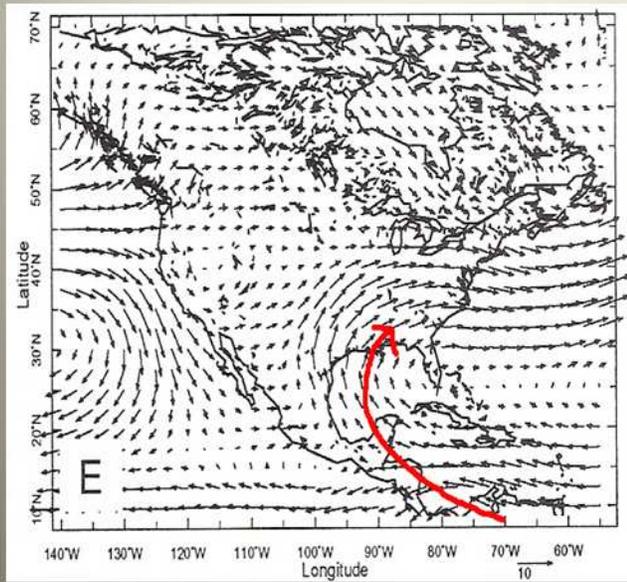
## Findings

- Peak stopover occurs during the first two weeks of April
- May favor primary forests to secondary forests or modified habitats
- Use the same sites in subsequent years
- Use a broad range of elevations
- Always found in mixed-species flocks
- Most flocks contained one (34%) or two (33%) Cerulean Warblers

## Findings cont.

- 28% responded to playback
- Mostly silent (10% singing spontaneously)
- Cerulean Warblers were found in a narrow arc stretching from eastern Chiapas, Mexico to western Honduras
- Model adequately predicted Cerulean Warbler presence in Central America during spring migration. Refinement and validation needed.

# Do all Ceruleans need to stop?



Winds aloft  
April  
at 1,525 (m)

Gauthreaux et  
al. 2005

## Acknowledgments

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- **Field Assistants** - Gregorio Lopez Avila, Sara Barker, Jorge Barraza, Kelvin Bodden, Daniel Boone, Francisco Cabanas, Eloise Canfield, Roberto Downing, Manolo García, Pablo Herrera, Nery Osvaldo Jurado, Johana Mejia, Jorge Martínez Ortega, Wilfred Requena, David Shoch, Elizabeth Shoch, Luis Soto, Juan Carlos Sorto, Ricardo Steiner, Hugo Enríquez Toledo, Jaime Talavera, Francisco Urbina, Lemuel Alfredo Valle, Wilson Miguel Vasquez, Ramon Osmar Guerrero Vázquez

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NMBCA



# Questions?



