

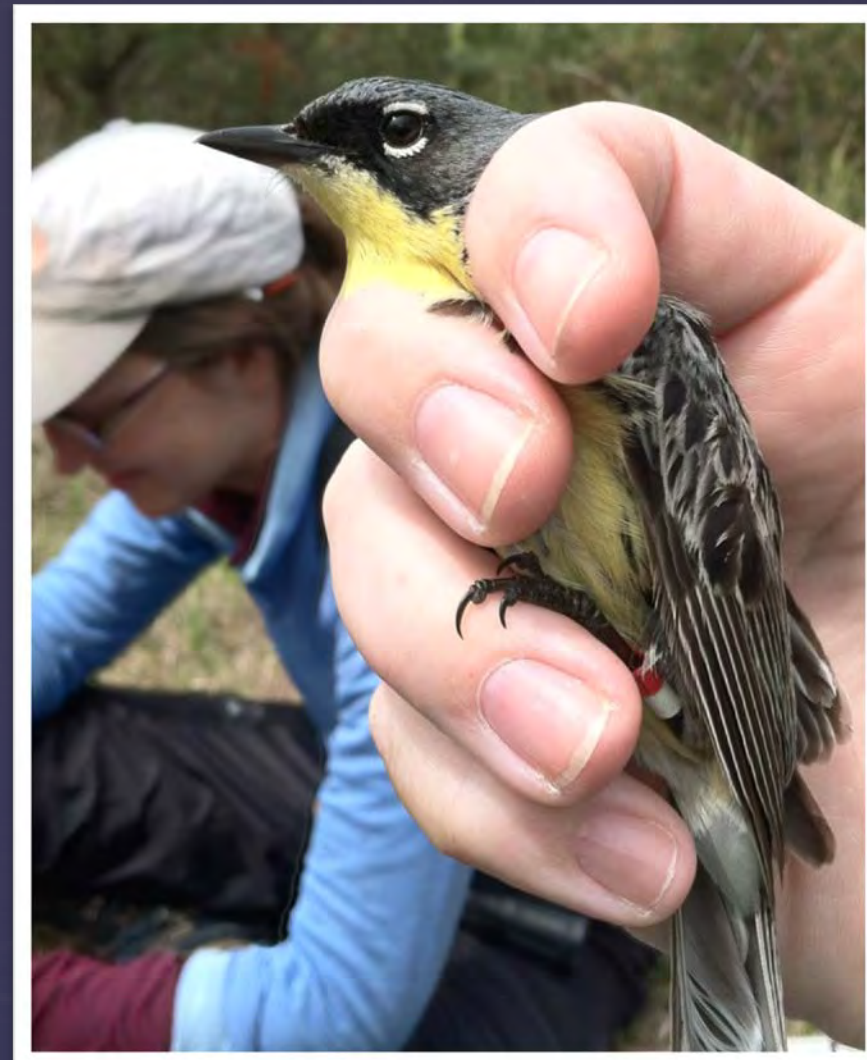


Discovering the Migratory Connectivity for the Endangered Kirtland's Warbler.



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Sarah Rockwell and Nora Diggs prepare to attach a geolocator on the breeding grounds in Northern Michigan

Introduction

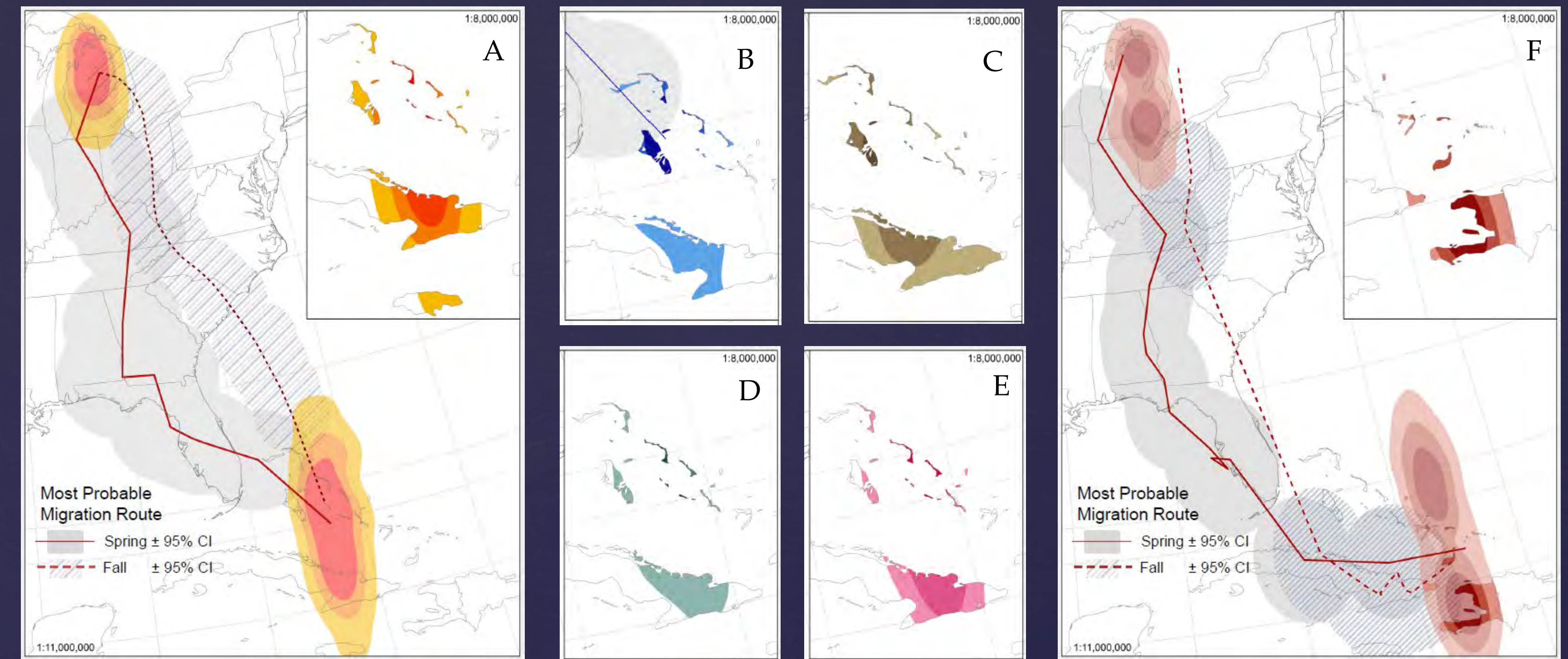
Understanding migratory connectivity is essential to species conservation. This is especially true for the endangered Kirtland's Warbler (*Setophaga kirtlandii*) that primarily breeds in the Jack Pine habitats of Michigan but has a poorly known migratory and winter distribution.

Methods

In summer 2012, we attached twenty-four light-level geolocators (Lotek, Inc.) to male Kirtland's Warblers in Michigan. Twenty-nine Kirtland's were captured and observed as controls. We followed both groups throughout the breeding season where site persistence, nest success and numbers fledged were measured. Birds were resighted and recaptured in 2013.



A Kirtland's Warbler wintering in The Bahamas



| Preliminary data | Fall Migration | | | Spring Migration | | |
|------------------|----------------|----------|--------|------------------|---------|--------|
| | bird | depart | arrive | days | depart | arrive |
| A | 10/6/12 | 10/31/12 | 25.00 | 4/24/13 | 5/15/13 | 21.00 |
| B | unknown | unknown | | 4/27/13 | 5/15/13 | 18.00 |
| C | 10/6/12 | 10/22/12 | 16.00 | 4/27/13 | 5/16/13 | 19.00 |
| D | 10/3/12 | 10/20/12 | 17.00 | 4/27/13 | 5/19/13 | 22.00 |
| E | 10/6/12 | 10/16/12 | 10.00 | 4/27/13 | 5/14/13 | 17.00 |
| F | 10/9/12 | 10/29/12 | 20.00 | 4/25/13 | 5/18/13 | 23.00 |
| Averages | | | 17.60 | | | 20.00 |

| | Geolocator | Control |
|-----------------|-------------------------|--------------------------|
| capture 2012 | 24 | 29 |
| resight 2012 | 67% (n=24) | 89% (n= 27) ^a |
| nest found | 63% (n=16) | 42% (n=24) |
| nest fledge | 72% (n =7) ^b | 92% (n=10) |
| average fledged | 4.2 (n=5) | 3.9 (n=9) |
| resight 2013 | 44% (n=16) ^c | 27%(n=22) ^a |

^a 2 individuals not searched for

^b no data on 3 nests, 2 fail

^c 1 missing geolocator

Results

We recovered 6 geolocators. Fall migration in 2012 commenced between October 3rd to 9th. One individual left earlier and could not be mapped because of movement during the fall equinox (7 Sept – 6 Oct). For the remaining five warblers, fall migration took on average 18 days. Non-breeding locations varied, but most overwintering sites were centered on The Bahamas, but could also include northeastern Cuba and western Haiti. Spring migration commenced from between April 24th to 27th, followed a more western route compared to fall, and took on average 20 days.

We found minimal evidence that geolocators resulted in negative impacts. After attachment, over-summer persistence was lower but annual return rates higher for geolocated versus control Kirtland's, both lower than reported in previous studies (50-65%). Nest success was similar for geolocated versus controls warblers.

Discussion

Geolocators are a useful tool for quantifying the migratory connectivity for a small endangered species. We found that Kirtland's occupy a broad range of The Bahamian islands and perhaps Cuba and Hispanola. Geolocators also helped elucidate broad migration paths.

Determining the migratory routes and winter distributions of Kirtland's warblers throughout the annual cycle is a high conservation priority and will help inform future efforts to locate and protect essential migratory stopover and winter habitats.