Differential Timing of Spring Migration between Sex and Age Classes of Yellow-rumped Warblers (*Setophaga coronata*) in Central Alberta, 1999-2015

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Introduction

The arrival date of passerines on their breeding grounds plays an important role in the reproductive success of both males and females (Smith and Moore, 2004). The pattern of arrival timing of sex classes in passerines is similar in many species as typically males arrive before the females (Francis 1986; Smith and Moore, 2004). This is due to a range of factors such as males that arrive earlier onto the breeding grounds have an increased chance at winning a female mating partner and the opportunity to gain valuable breeding space and food resource (Smith and Moore, 2004; Stewart et al. 2002).

Arrival dates of age classes within the sexes typically show after second year (ASY) males to arrive before the younger second year (SY) males (Stewart et al., 2002). Lesser known is the differential timing between female age classes, where studies have shown that ASY females arrive both before and after SY (Francis and Cooke, 1990; Stewart et al. 2002). This has been presumed due to a number of factors including plumage, intraspecific competition, or habitat quality (Stewart et al., 2002).

The yellow-rumped warbler (*Setophaga coronata*) is separated by the Rocky Mountains into two subspecies, the myrtle warbler (*Setophaga coronata coronata*) on the east side and the audubon's warbler (*Setophaga coronata auduboni*) to the west (Mila et al., 2008). The myrtle warbler's breeding grounds are across the boreal forest in North America and winters along the Atlantic coast (Mila et al., 2008). This results in the myrtle warbler migrating through central Alberta, usually in large numbers (Mila et al., 2008).

The objective of this study is analyze historical myrtle warbler migration data to determine the differential timing between migrating males and females; SY and ASY; male SY and ASY; and female SY and ASY. It is predicted that male and ASY myrtle warblers will migrate ahead of female and SY myrtle warblers.

Methods

The study area was the Beaverhill Lake Natural Area, located 65km east of Edmonton, AB. The area is an aspen-poplar dominated forested area in the Parkland Region of Alberta and has been known as a migration hotspot and stopping grounds due to the lake and surrounding food sources. Sitting in the natural area is the Beaverhill Bird Observatory, which has been collecting migration data since 1984.

To capture the birds, generally 13 mist nets were operated in the Beaverhill Lake Natural Area. Nets were 2m high by 12m long, with 30mm mesh. Netting began on May 1st and lasted till the end of spring migration, approximately a 6 week capture period. Nets were opened a half-hour before sunrise, checked every half hour for 6 hours, then closed for the day. Extreme weather conditions such as temperatures below 0°C, wind >3 on the Beaufort scale or rain either delayed opening nets or didn't allow any netting on that day. Birds caught in the nets were extracted and transported the BBO lab to be aged and sexed.

The myrtle warblers were aged and sexed according to the Identification of North American Birds (Pyle 1997). Age was determined by color, shape and amount of wear on wing and tail feathers (Pyle 1997). Identification of sex was determined by plumage with males generally having bolder black and yellow coloring versus the overall dullness of females (Pyle 1997). Also sex can be determined by presence of a cloacal protuberance, being male genitals (Pyle 1997). A brood patch could be found on a female, but rare during this period in their migration (Pyle 1997). Besides being banded, aged and sexed, birds were also weighed, had tail and wing measured, and feather wear rated. Birds were released following the process.

Age, sex and arrival date data from 1999-2015 in Bandit was organized for myrtle warblers. After hatch years (AHY) and unknown sexes were not included because one can only speculate their actual age/sex. AHY designates a bird where age cannot be determined. Recaptures were to be counted twice, if on different years. Dates were calculated into Julian date to remove issues surrounding leap year.

Data was first tested using an f-test for equal or unequal variance in the two samples, then performing a t-test using ether unequal or equal variance depending on the f-test result.

Results

Historical records showed a total of 571 myrtle warblers being caught by BBO mist nests during the spring migration between the years of 1999-2015. AHY (n=27) and unknowns (n=11) were not included because age/sex could not be identified.

Males (n=367), on average, arrived significantly (t-test, p=6.03E-10) before females (n=193) (Figure 1). ASY females (n=95), on average, arrived significantly (t-test, p= 4.44E-07) before SY females (n=87) (Figure 2.). ASY males (n=120), on average, arrived significantly (t-test, p= 1.01E-07) before SY males (n=234) (Figure 3.).

Note that myrtle warblers were caught when netting was initiated on May 1 indicating that their migration passage at BBO began in April.

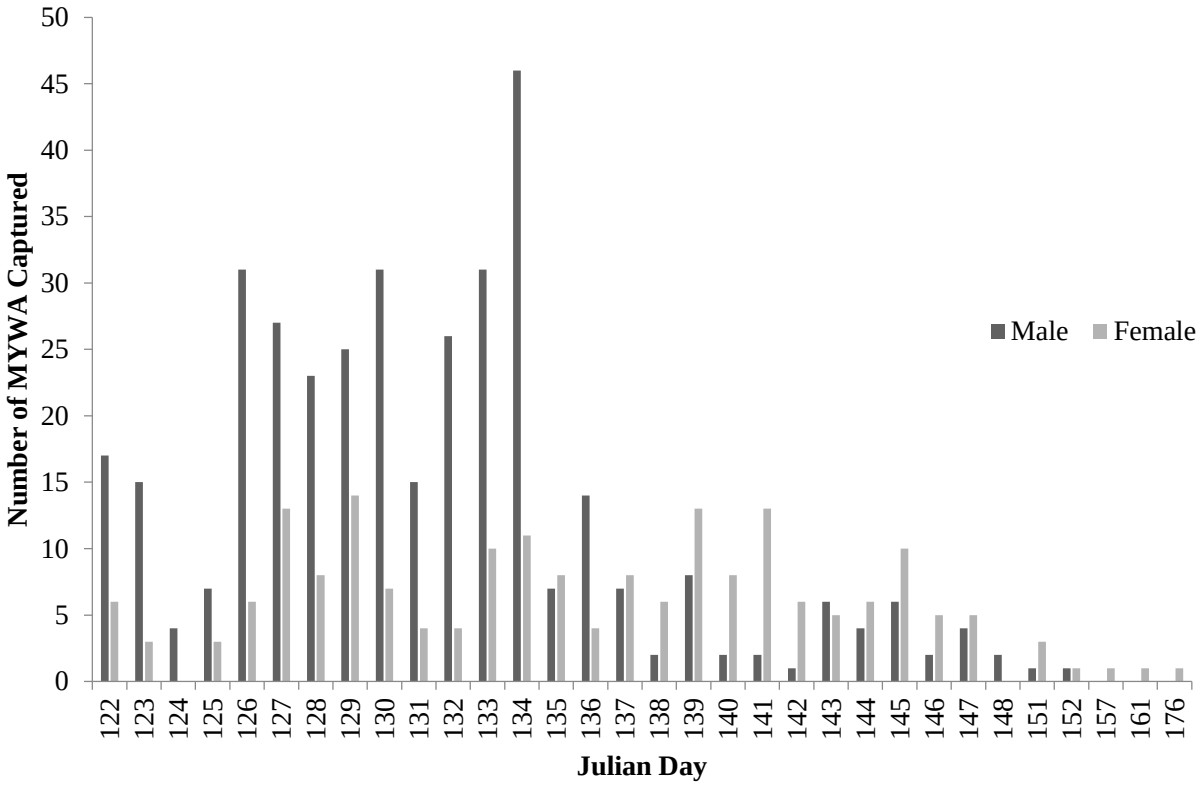

Figure 1. Frequency of Male (n=367) and Female (n=193) Myrtle Warblers caught on each date (Julian day), years 1999-2015 (t-test, p=6.03E-10)

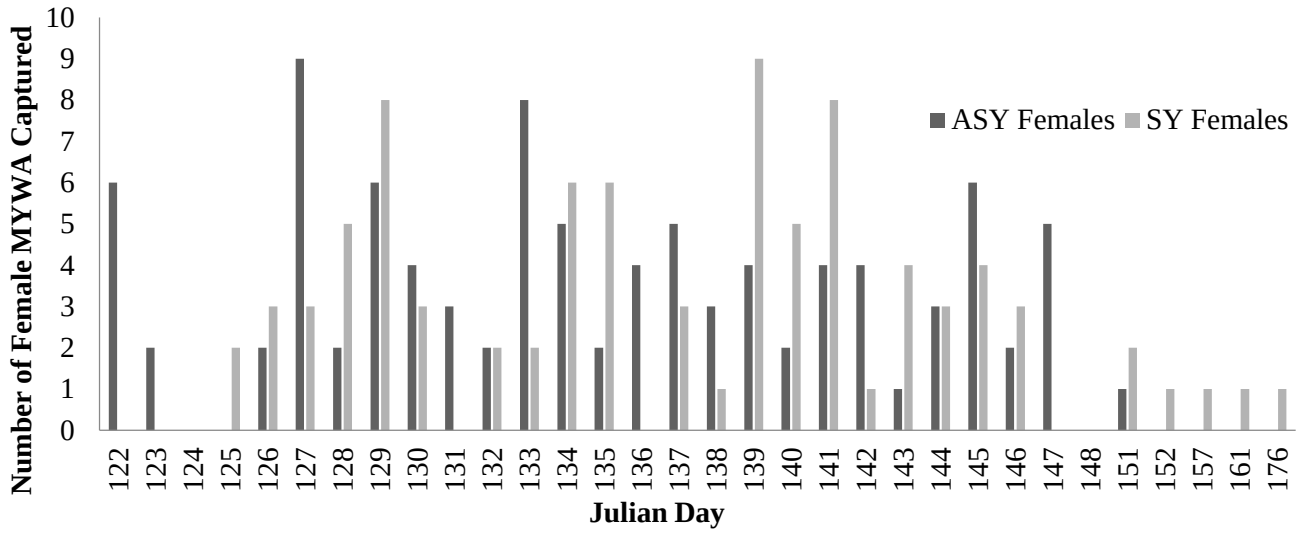

Figure 2. Frequency of ASY female (n=95) and SY female (n=87) Myrtle Warblers caught on each date (Julian day), years 1999-2015 (t-test, p= 4.44E-07)

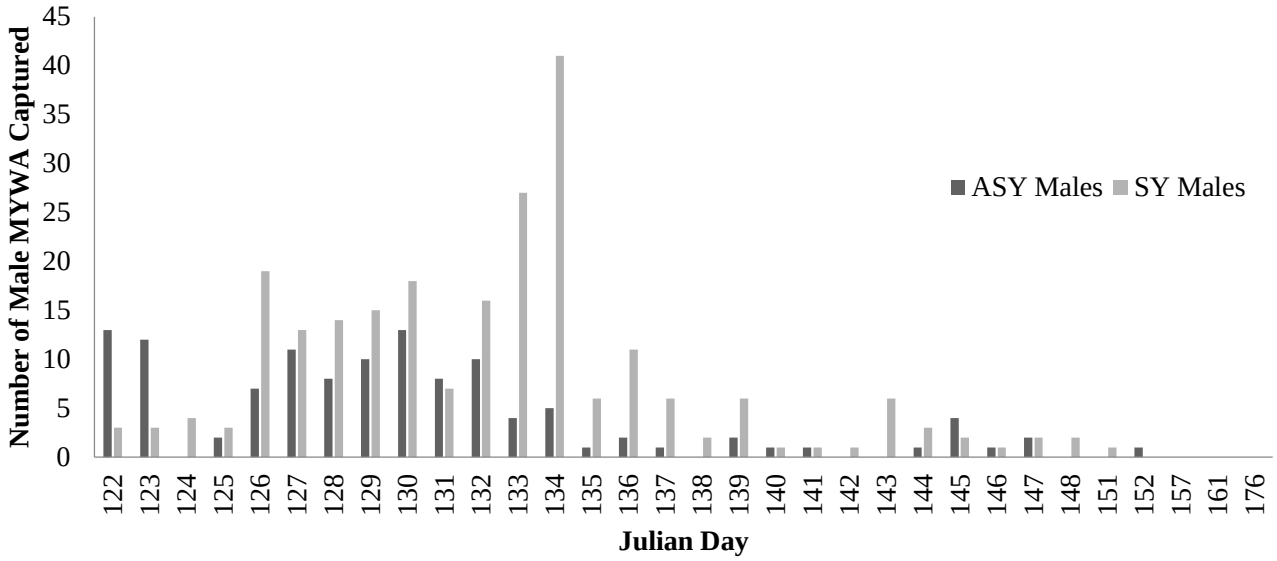

Figure 3. Frequency of ASY male (n=120) and SY male (n=234) myrtle warblers caught on each date (Julian day) years 1999-2015 (t-test, p= 1.01E-07)

Discussion

A sex based difference in timing of spring migration between male and female myrtle warblers was easily observed with males arriving, no average, significantly before the females. However there is considerable overlap in their migration through central Alberta. This is assumed for territorial reasons as the males need to reach the boreal first to establish breeding grounds (Smith and Moore, 2004; Stewart et al. 2002). Birds that arrive first on the breeding grounds usually get to breed first, thus early arriving males have a significant advantage over males arriving later, they have a higher chance of reproducing with more time, even possibly with more than 1 mate (Smith and Moore, 2004; Stewart et al. 2002).

Both ASY males and females arrived on average significantly ahead of their SY counterparts which was expect as the same results were observed in studies by Stewart et al. (2002) and Francis & Foote (1986). The reasons why however have not yet been confirmed, yet there are several hypotheses suggested for other passerine species (Stewart et al., 2002). One reason could be that SY males have less energy for migration due to dominance interactions during the wintering season (Stewart et al., 2002). As SY males occupy habitats that have decreased forage or cover, they may not be adequately conditioned for an early migration (Stewart et al., 2002). These same factors are likely the reasons why SY females arrive after ASY females.

In conclusion, significant differences in arrival times between males and females; ASY males and SY males; and ASY females and SY females was all observed in historical myrtle warbler capture data from BBO. The test could be replicated to observe if these trends are apparent in other warbler or passerine species.

In addition, since myrtle warblers are present at BBO on May 1, migration monitoring should be initiated in April to monitor the full migration period of this species. This would produce more accurate results and more myrtle warblers, most likely ASY males and females.

Acknowledgements

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