



Investigating the behavioral ecology of solitary *Orchelimum erythrocephalum*

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Introduction

It has been hypothesized that patterns of nocturnal behavior are exhibited by most katydid species as a defense to predation. During the day, individuals engage in little movement to lower the risk of being spotted by visual predators (Gwynne 2001). Meadow katydids, on the other hand, are generally thought to be diurnal and audibly signal both day and night (Morris and Walker 1976). However, little quantifiable data has been published on the diel habits of these species.

The red-headed meadow katydid (*Orchelimum erythrocephalum*) is distributed throughout eastern North America and is abundant in Alamance Co., NC. This species is a potential model organism for studying topics in behavioral ecology, such as predator avoidance, signaling and mate attractant behavior.

Here, we created a descriptive foundation of behavior for solitary male and female *O. erythrocephalum* in day and night contexts.

Figure 1. Study species *O. erythrocephalum*



Methods

- Conducted observations in two study sites in Alamance Co., NC during Aug and Sep 2019
- Filmed solitary male and female *O. erythrocephalum* in 20 min day and night trials
- Scored and quantified behavior from video
- Constructed activity budgets by calculating the proportion of time spent performing each behavior out of the total trial time
 - Compared behavior between sexes and day/night contexts using Kruskal-Wallis tests
- Calculated the transition frequencies between behavioral states using first-order transitional probability matrices
- Created ethograms for each context

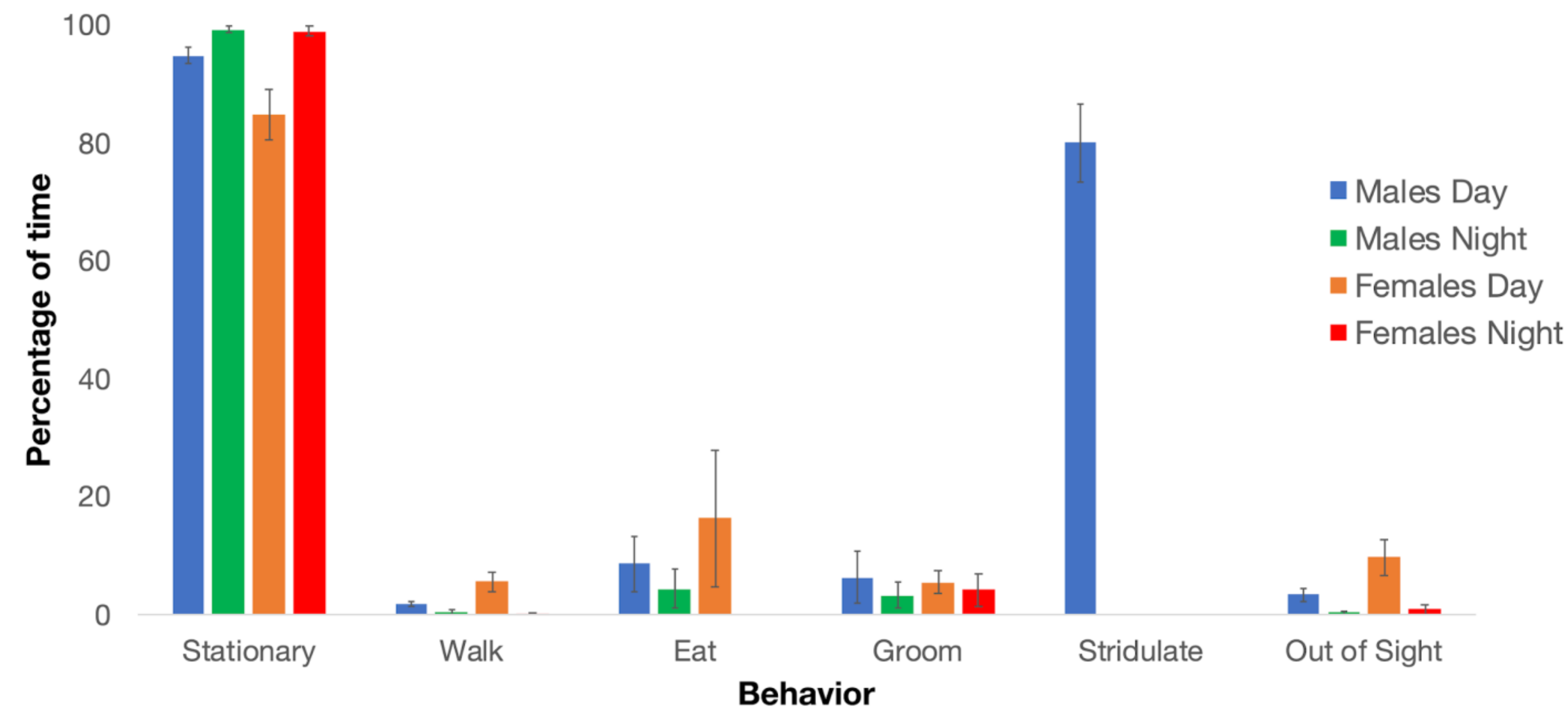
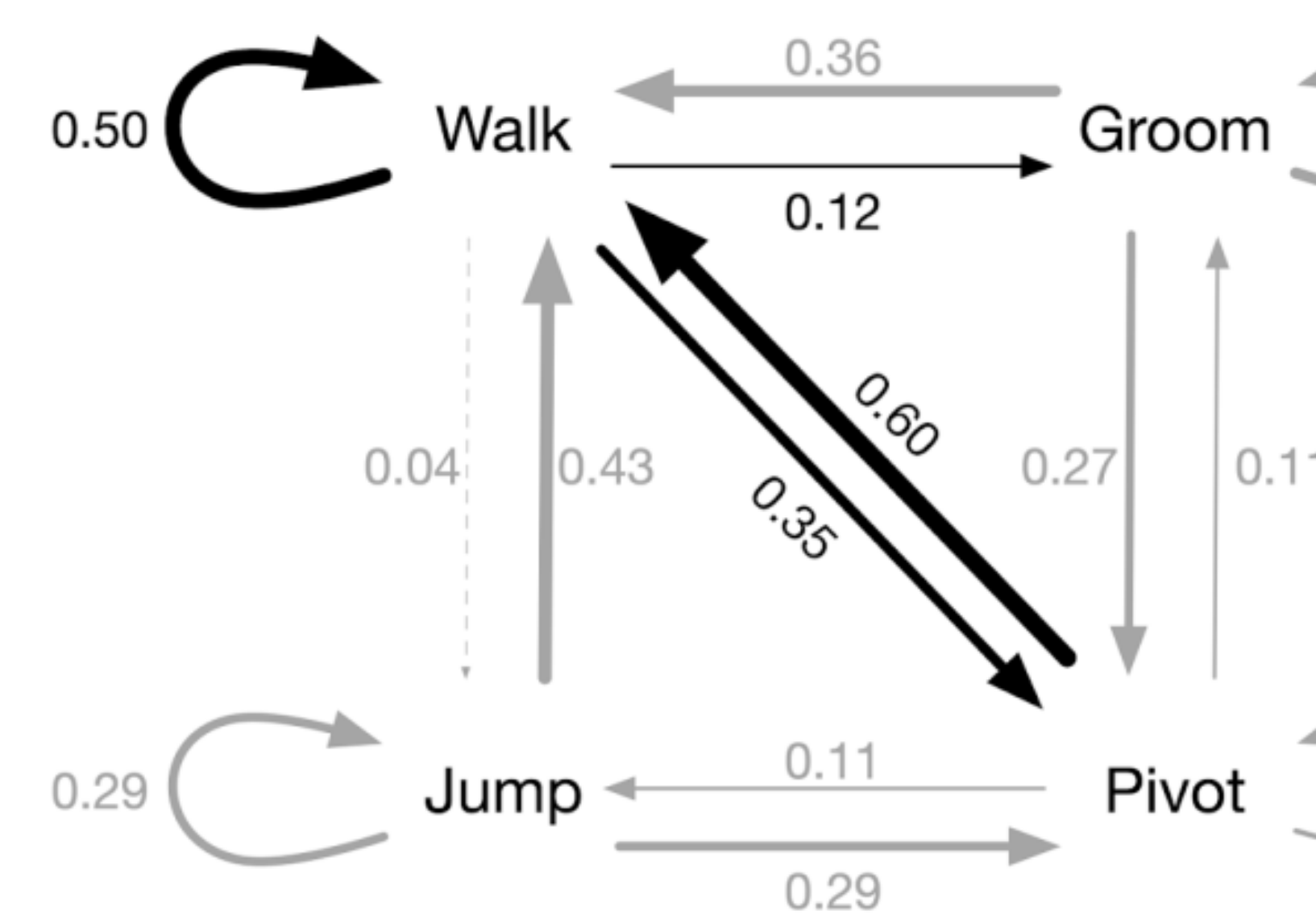
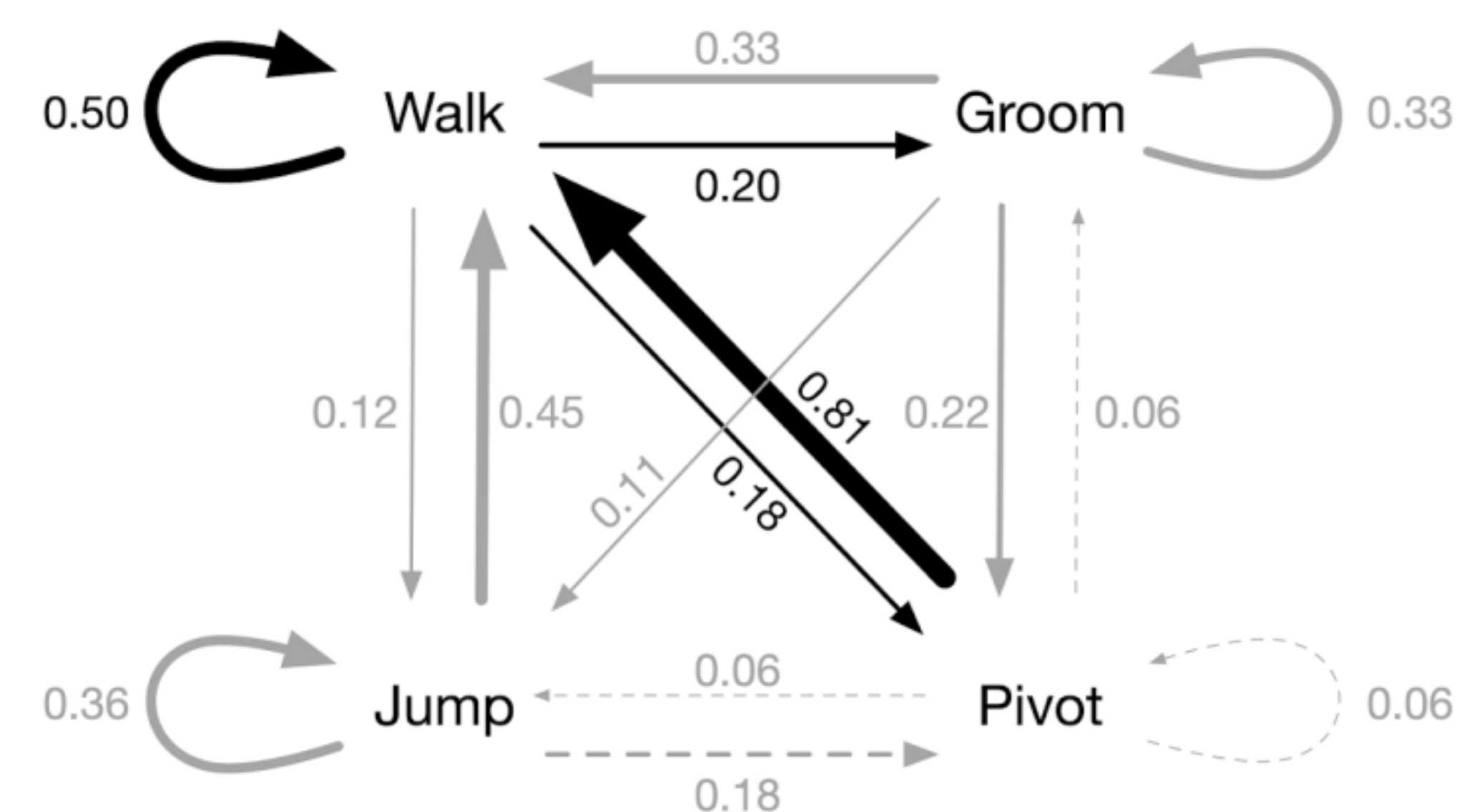


Figure 2. Activity budget of solitary *O. erythrocephalum* showing mean \pm SE percentage of time for Daytime Males (n=16), Nighttime Males (n=12), Daytime Females (n=6), and Nighttime Females (n=11).

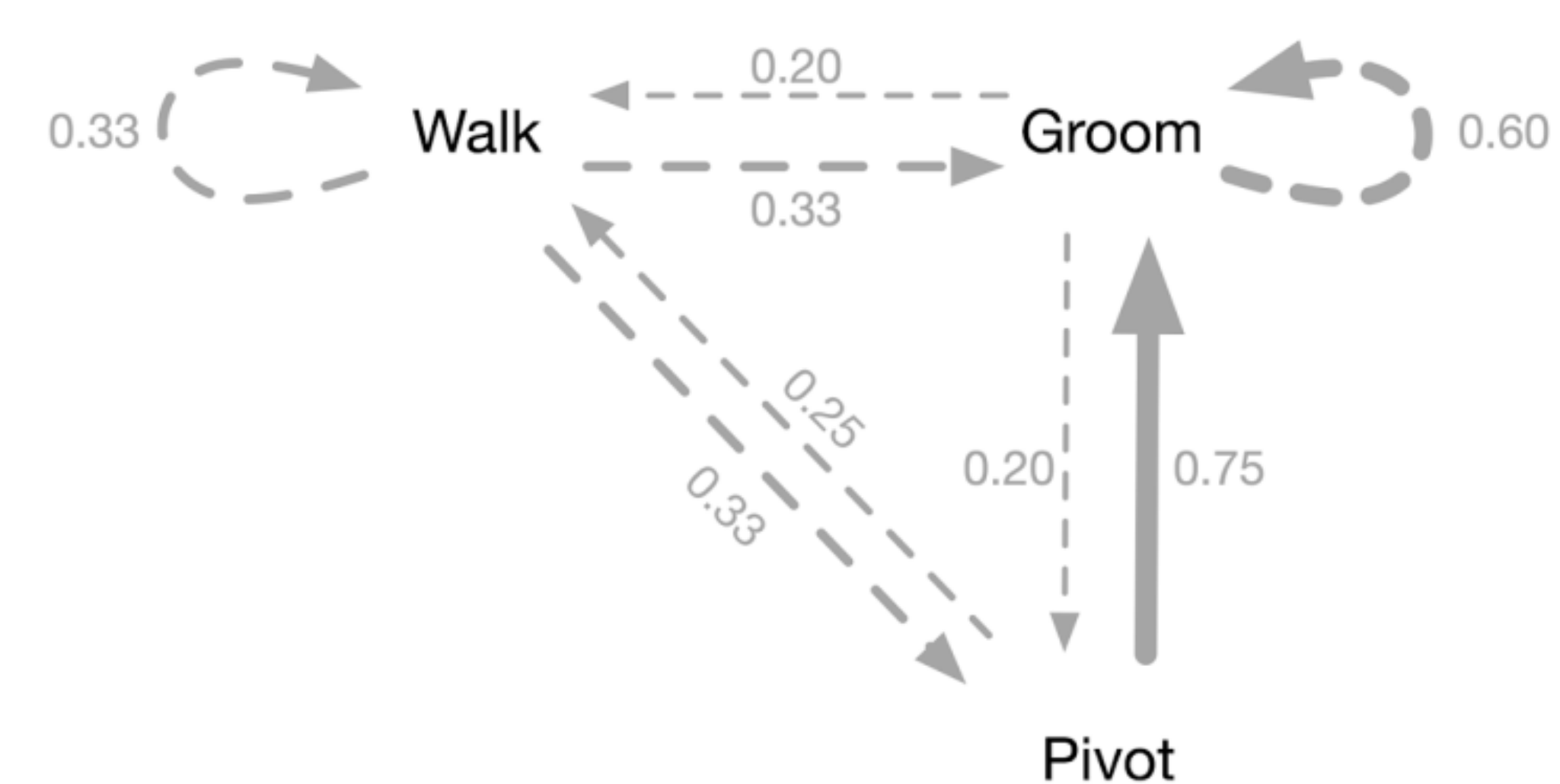
Solitary Daytime Males (n=16)



Solitary Daytime Females (n=6)



Solitary Nighttime Males (n=12)



Solitary Nighttime Females (n=11)

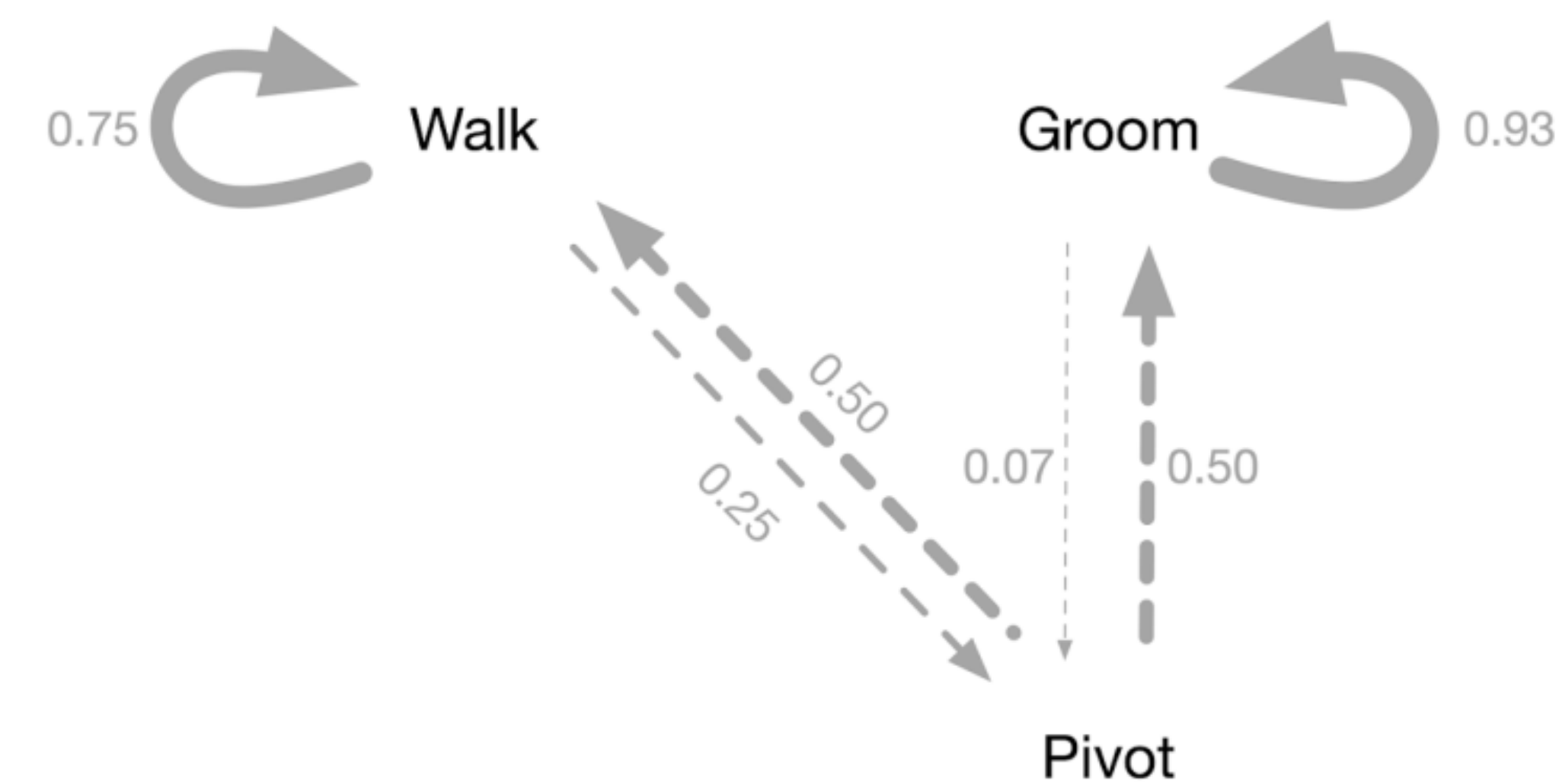


Figure 3. Kinematic diagrams of behavioral transitions in *O. erythrocephalum*. Thickness of lines are proportional to transitional frequencies. Transitions performed by < 5 individuals are indicated by gray lines. Transitions performed by < 2 individuals are indicated by dashed lines. Behaviors performed by only one individual are omitted.

References

- Gwynne DT. 2001. Katydid and bush-cricket: reproductive behavior and evolution of the Tettigoniidae. Cornell University Press.
- Morris G, Walker T. 1976. Calling songs of *Orchelimum* meadow katydids (Tettigoniidae). I. Mechanism, terminology, and geographic distribution. Canadian Entomologist. 108:785–800.

Results

- Both males and females spent more time walking (Kruskal-Wallis, $H=22.043$, 1 d.f., $P<0.0001$), grooming ($H=5.256$, 1 d.f., $P=0.022$), and eating ($H=5.728$, 1 d.f., $P=0.017$) during the day than at night (Fig. 2)
- Males stridulated for > 75% of the time during daytime trials, but no male ever stridulated at night
- Females walked for more time than males during the day ($H=5.568$, 1 d.f., $P=0.018$)
- Behaviors such as jumping and pivoting were most frequently followed by walking during the day (Fig. 3)

Anecdotal Observations

- A female was attacked by a wolf spider during a night trial
- A female was observed with an attached spermatophore at night, indicating a recent mating
- A signaling male was observed to locate and tackle a neighboring signaling male during the day

Discussion

- Differences in activity between day/night contexts and between sexes may be driven at least in part by predation risk
 - Both male signaling and female movement may increase individual predation risk

Future Work

- Do males not signal at night due to individual risk or because females will not respond?
- Do playbacks of male calling songs attract females/predators?
- Is nighttime signaling limited by temperature?
- Is mating behavior exclusively diurnal?

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