The contribution of interactions to arthropod community structure depends on the place and time: Why community ecologists should think locally and regionally

Matthew K. Lau, Laura E. Hagenauer and Thomas G. Whitham

Department of Biological Sciences
Northern Arizona University

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  - Brooks *et al.* 2009

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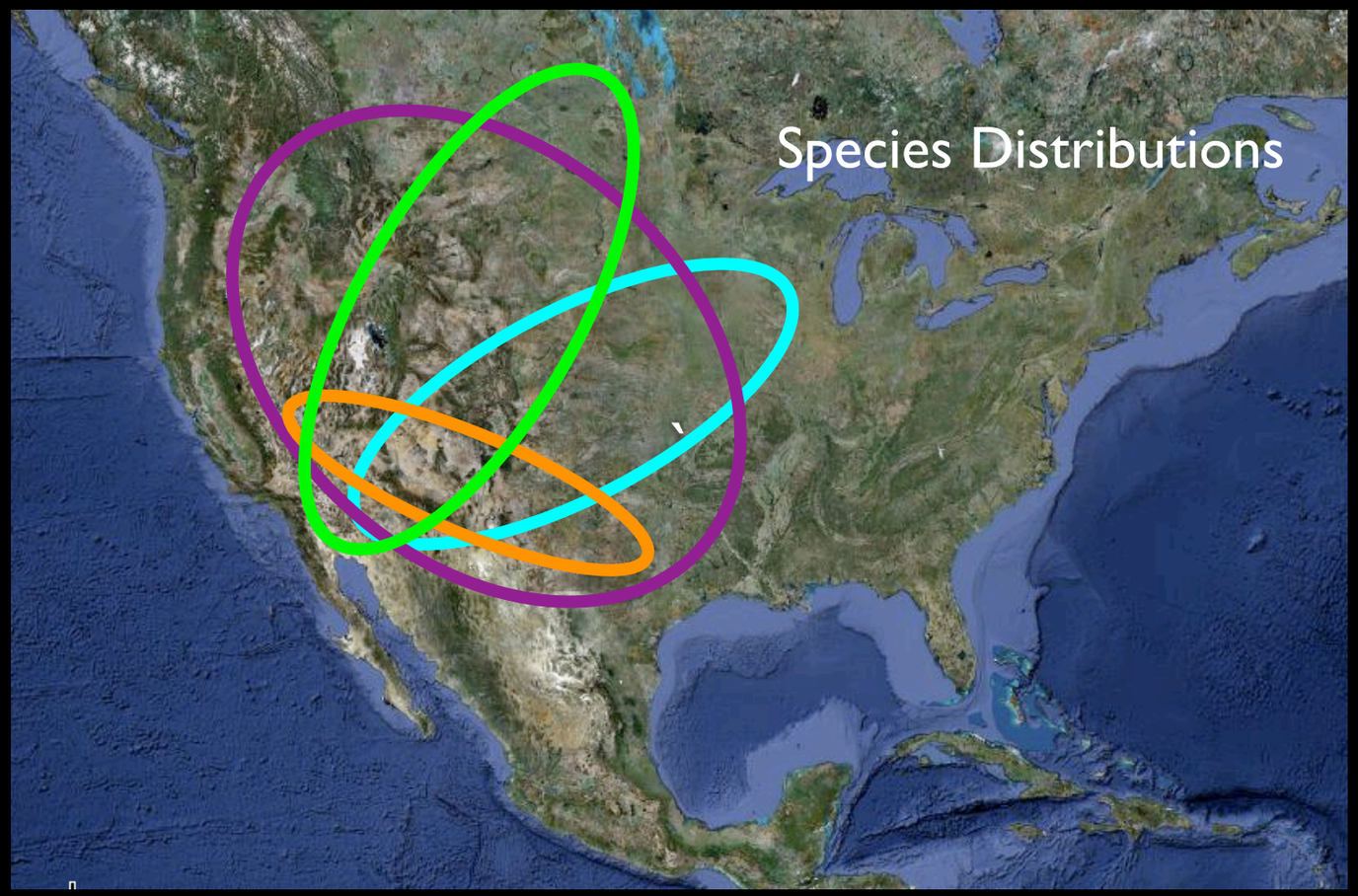

Regional Scale

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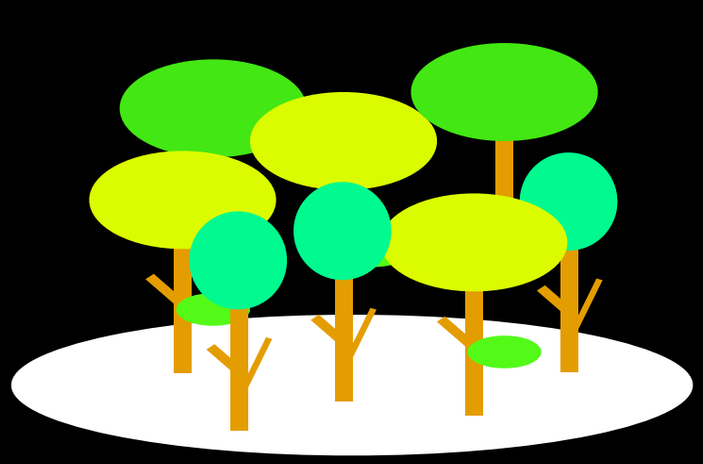

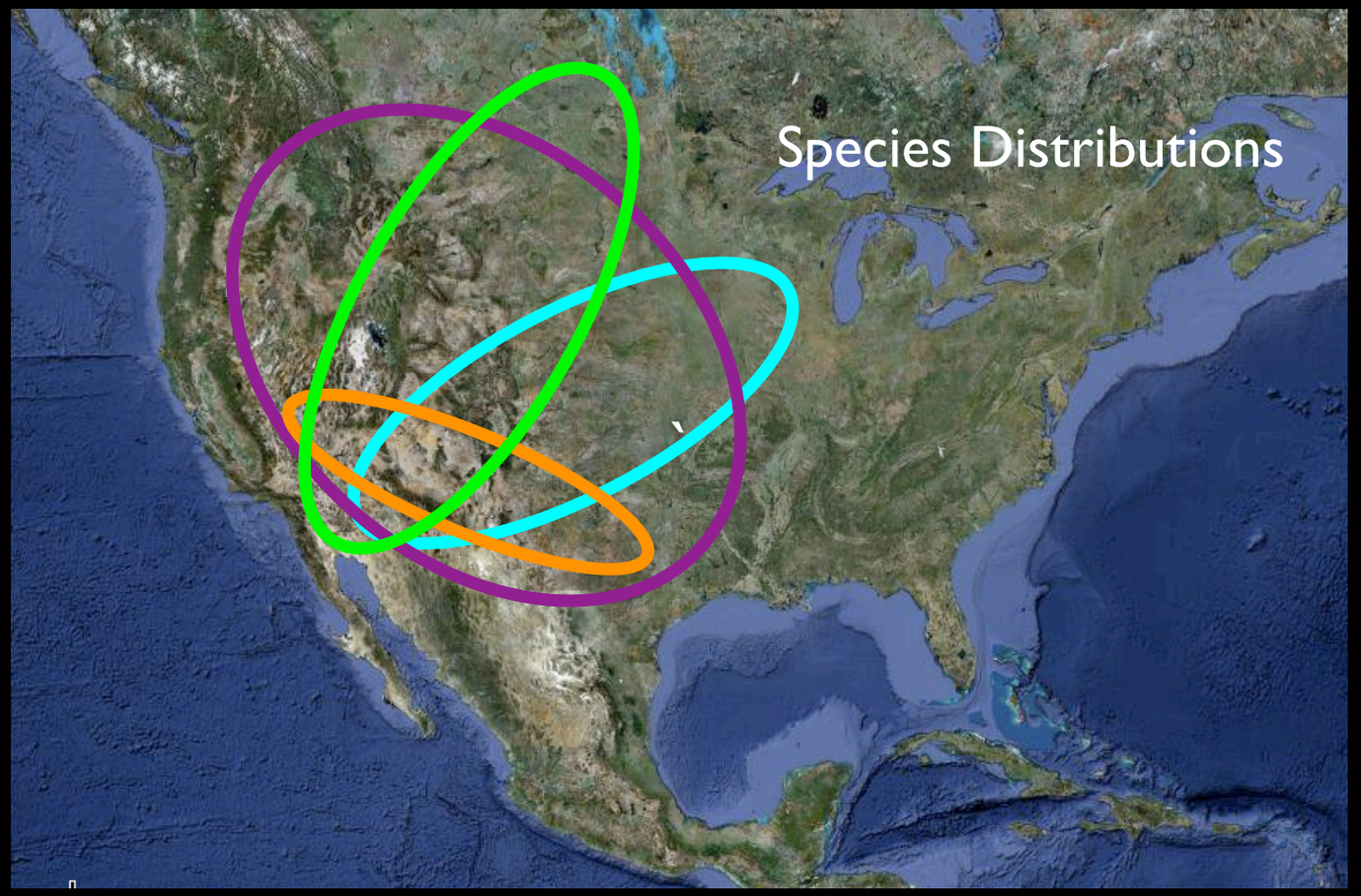

Local Scale

Regional Scale

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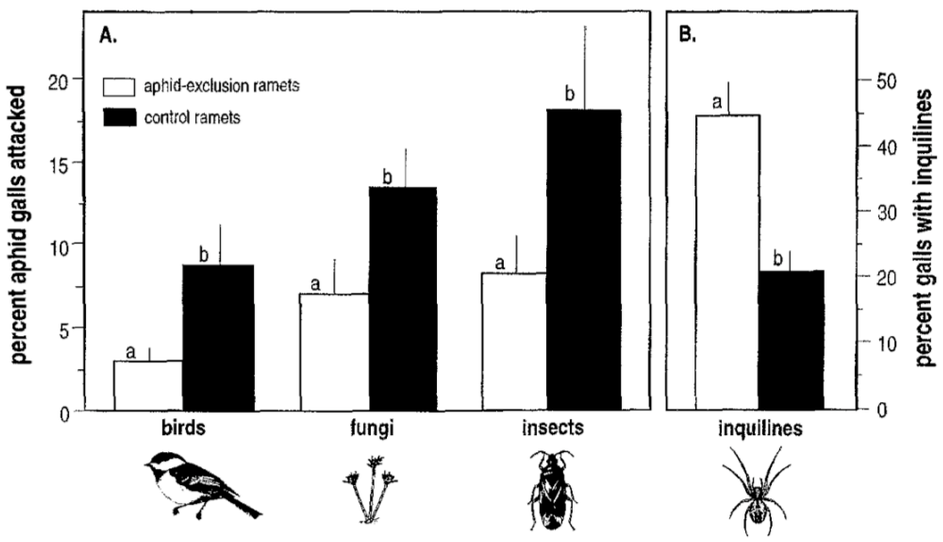
- What does this mean for the study of communities?

Canopy Arthropod Community



Dickson and Whitham 1996

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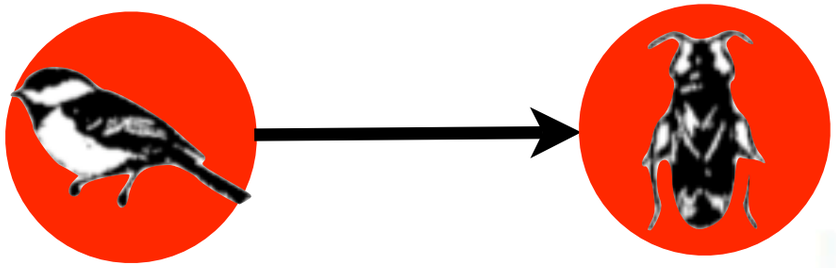

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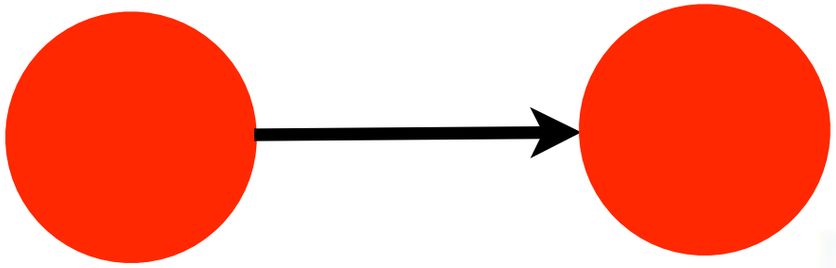

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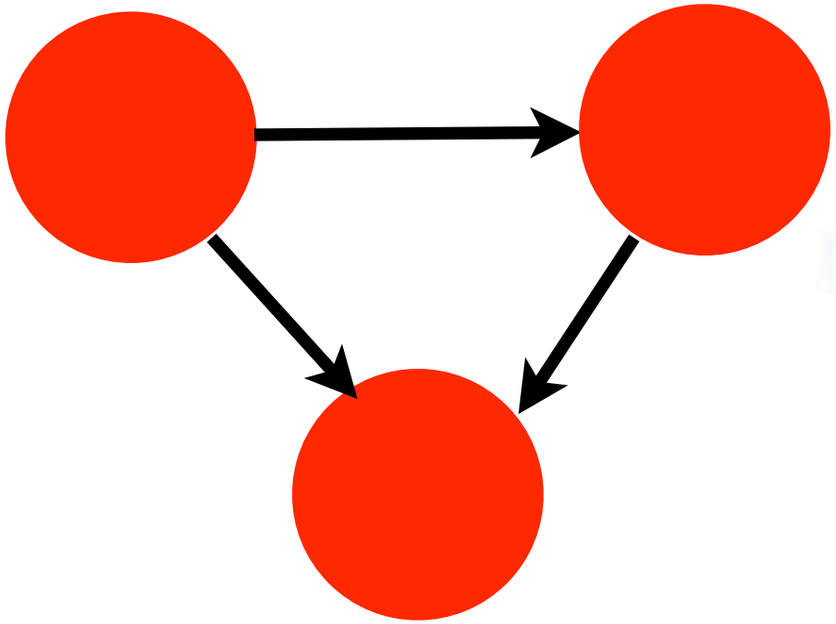

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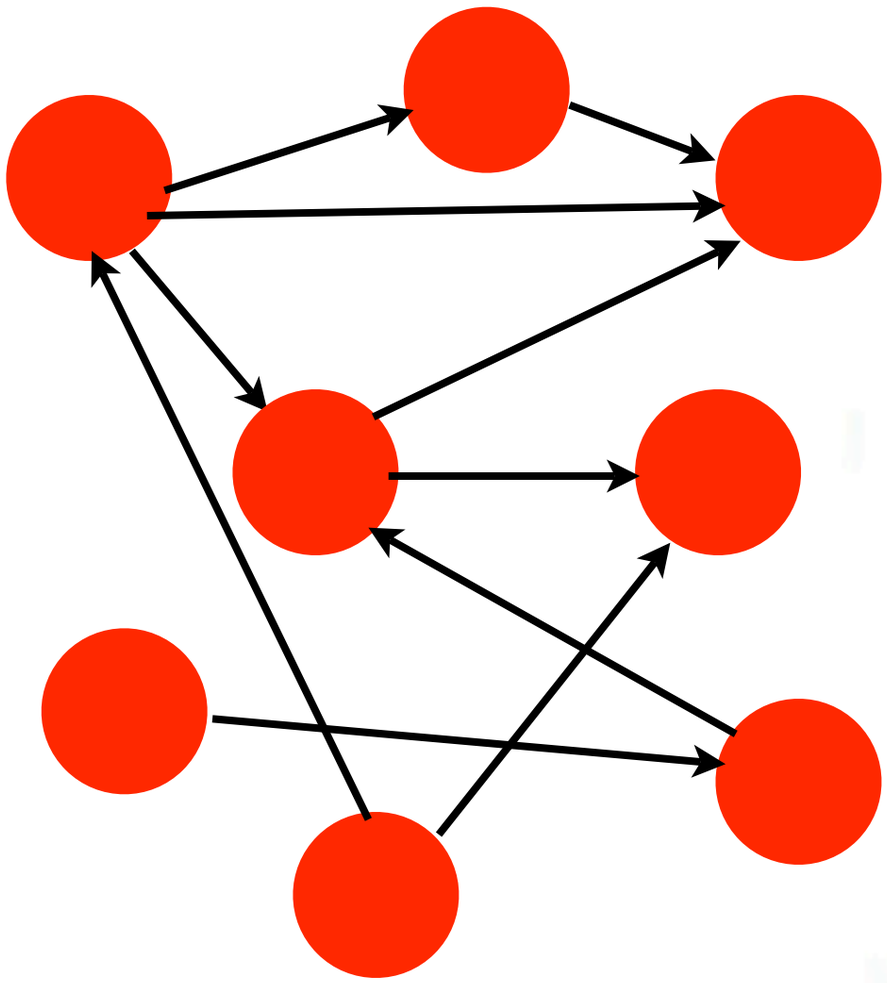

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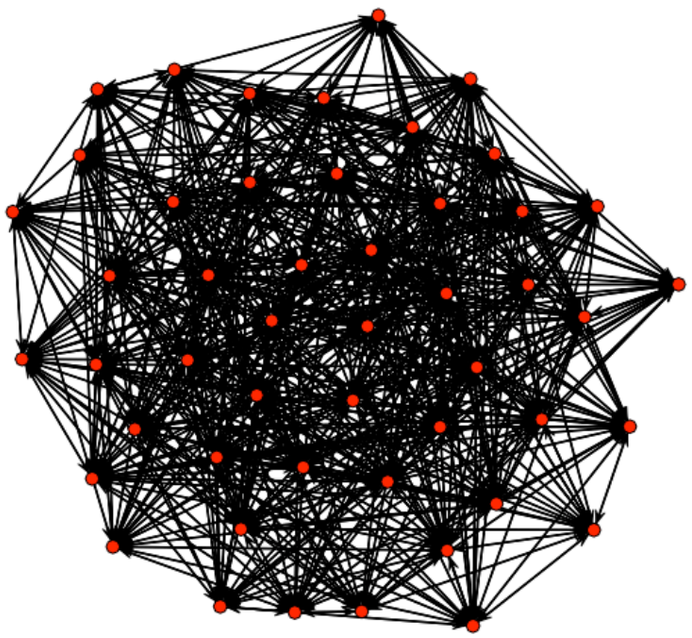

Canopy Arthropod Community

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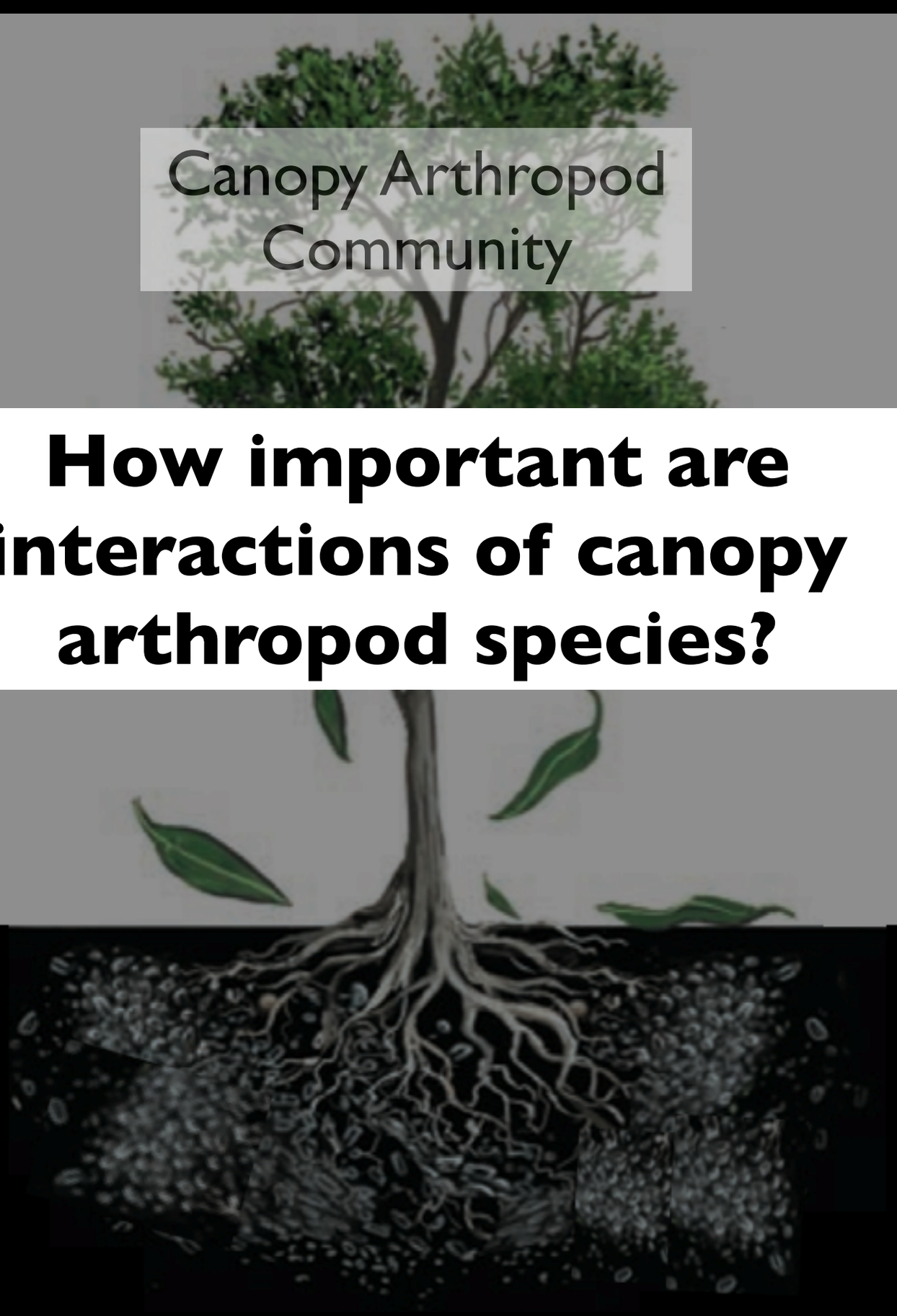
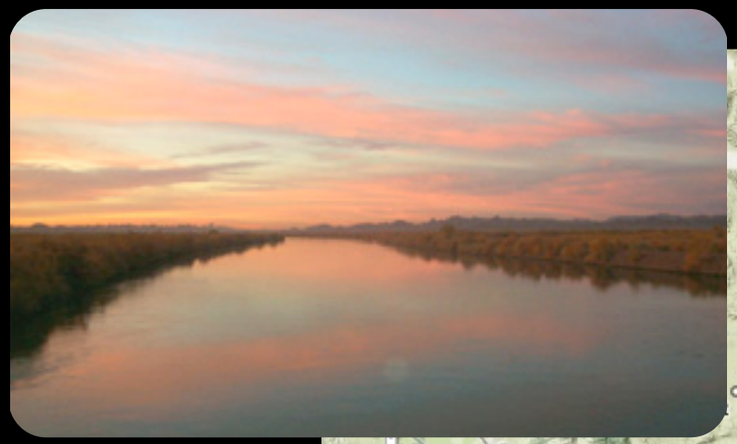
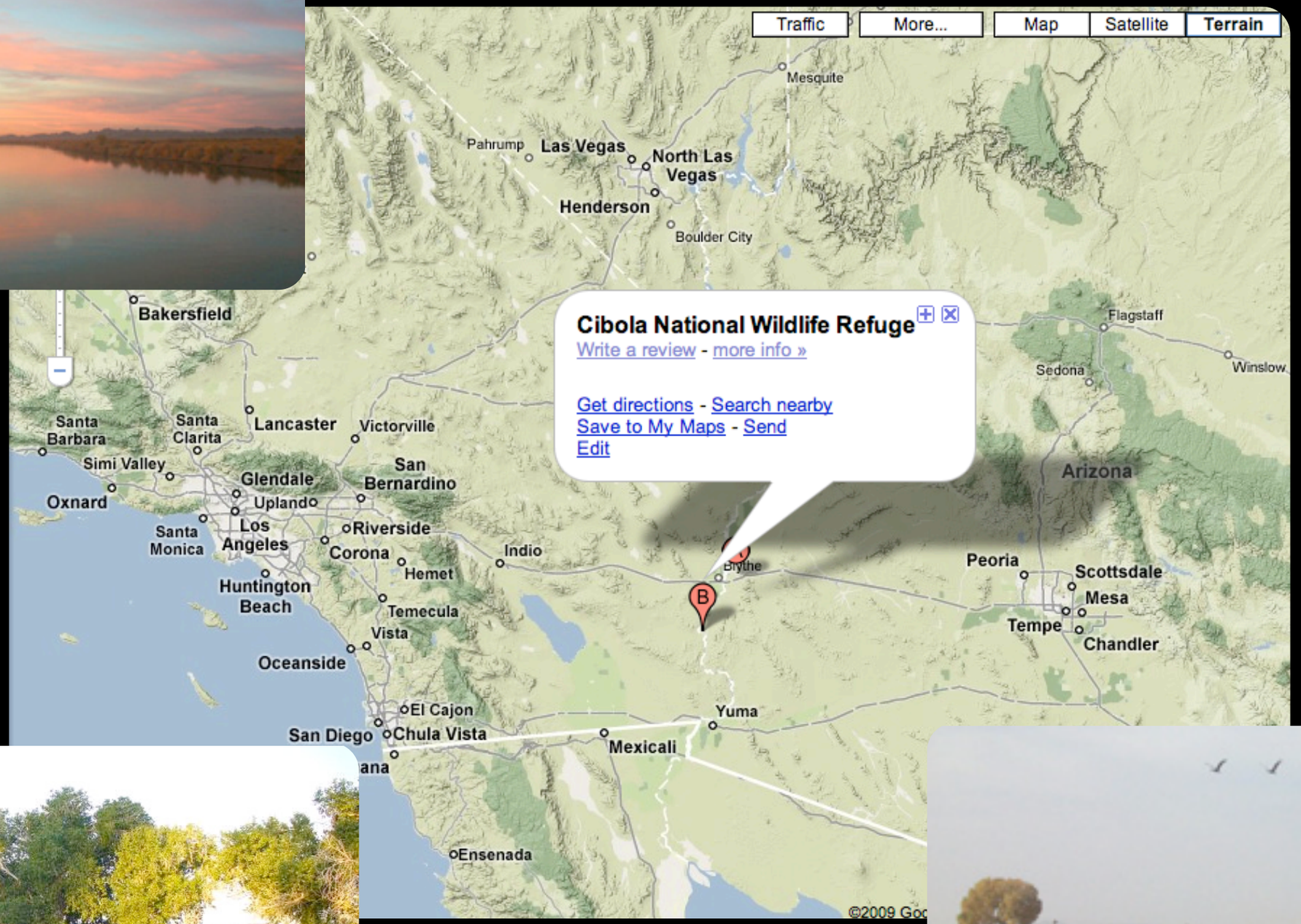
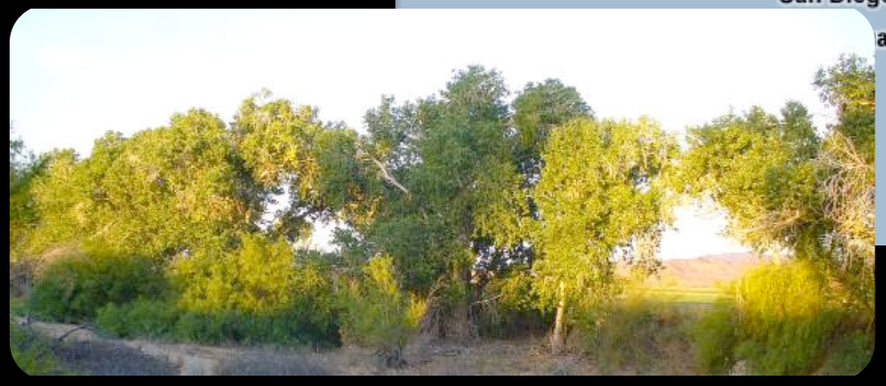
How important are interactions of canopy arthropod species?

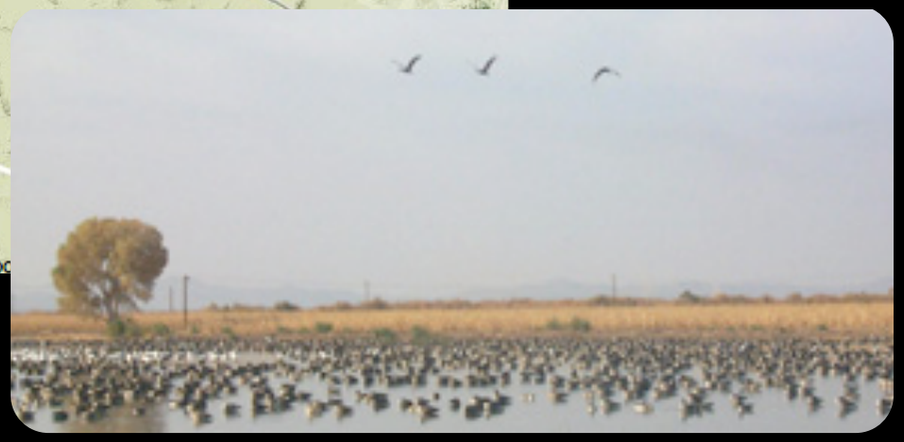


Study System









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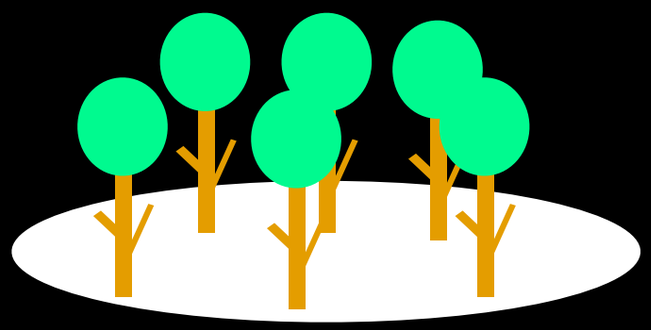

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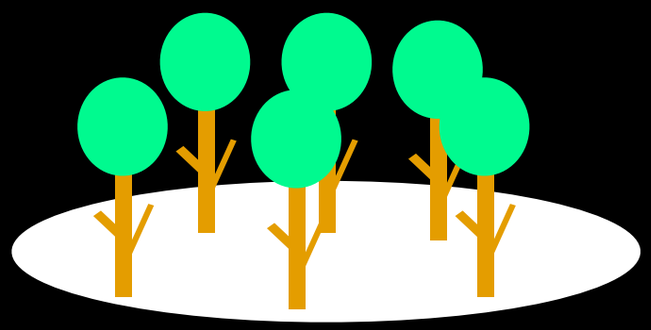

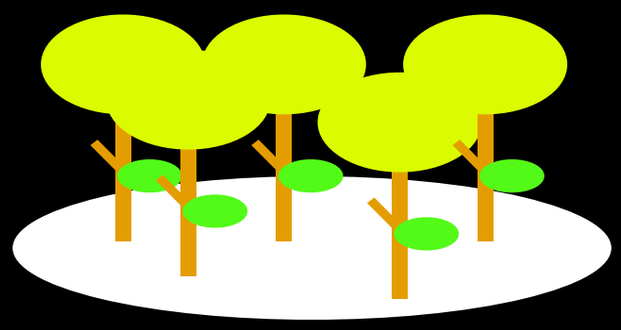

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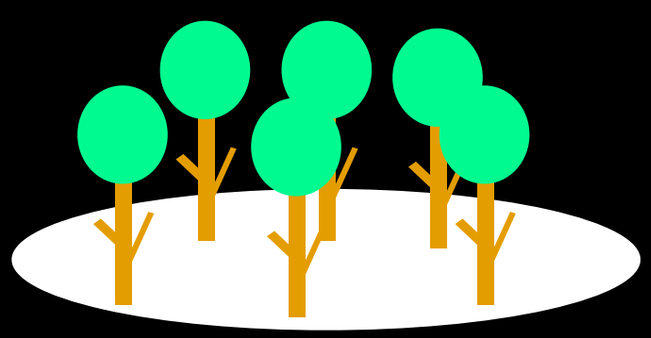

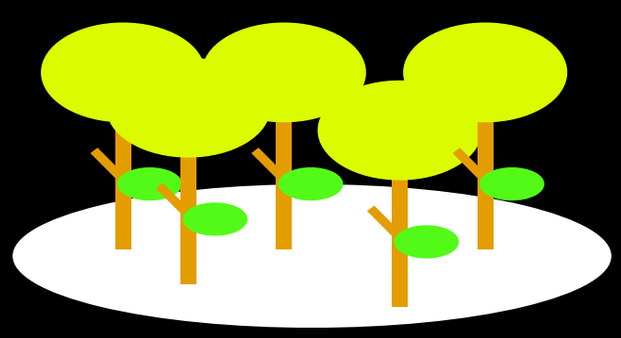

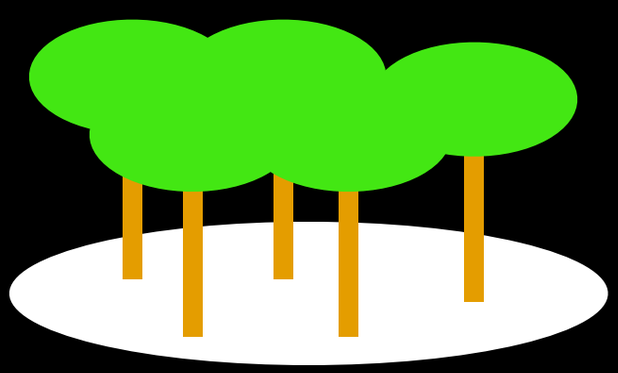

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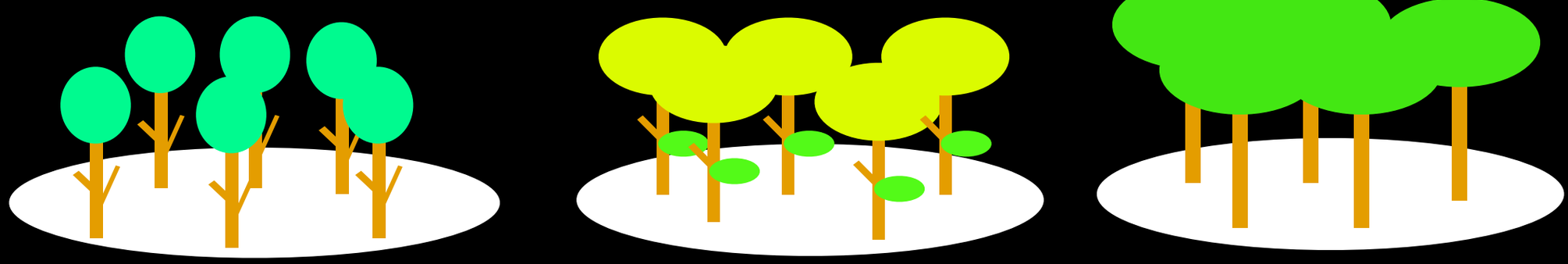

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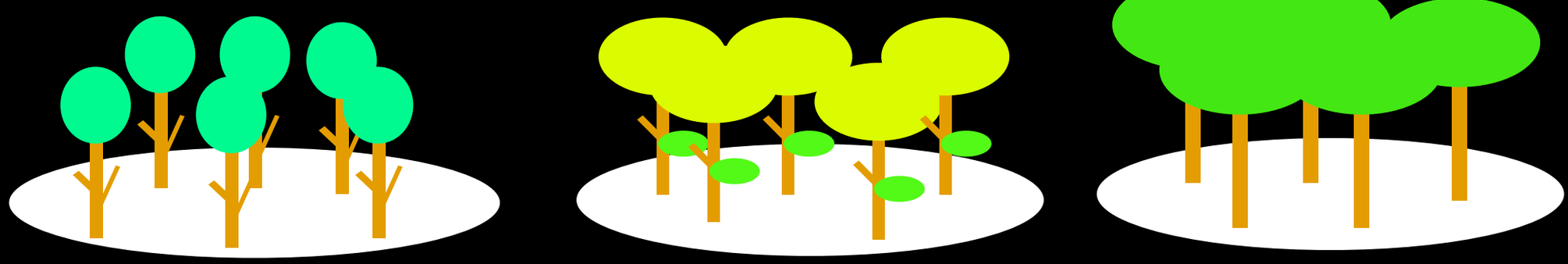

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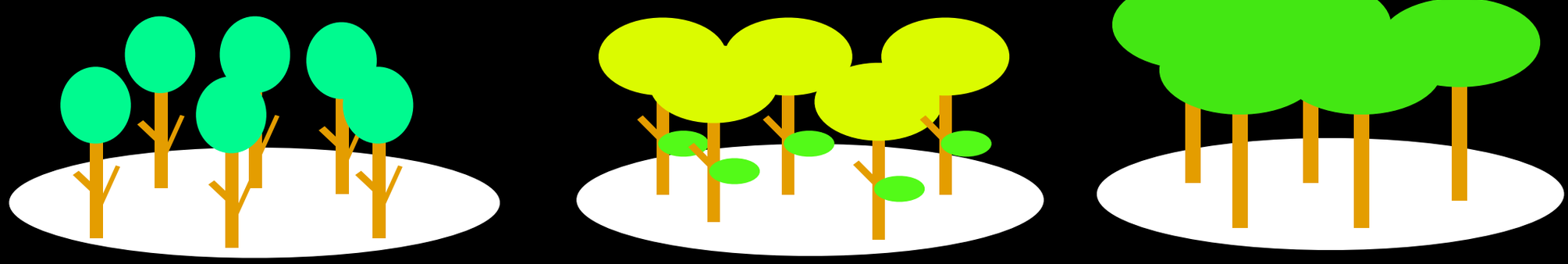

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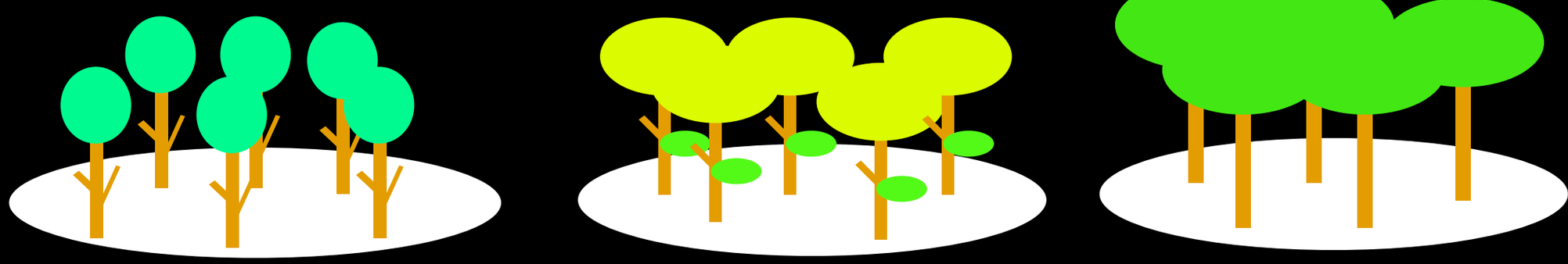

Co-occurrence Analysis

Gotelli and Graves 1996

Co-occurrence Analysis

Occurrence Matrix

Species	Obs1	Obs2	Obs3
Sp1	1	1	0
Sp2	0	0	1
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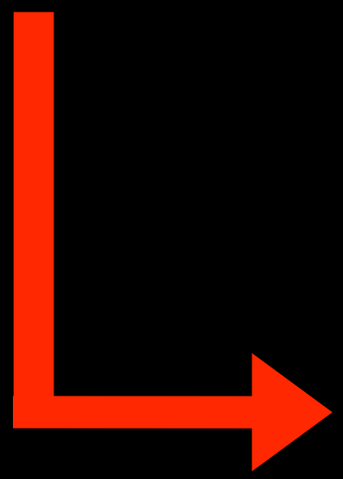

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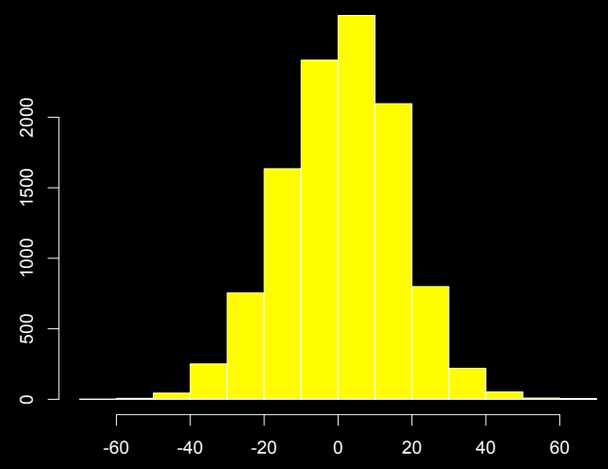

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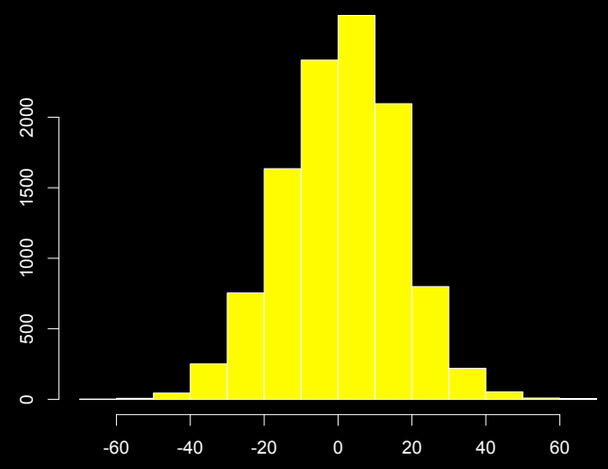

Null Model Index Estimate

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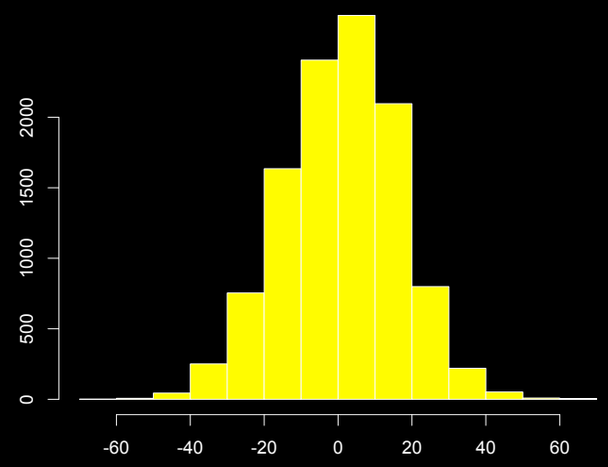

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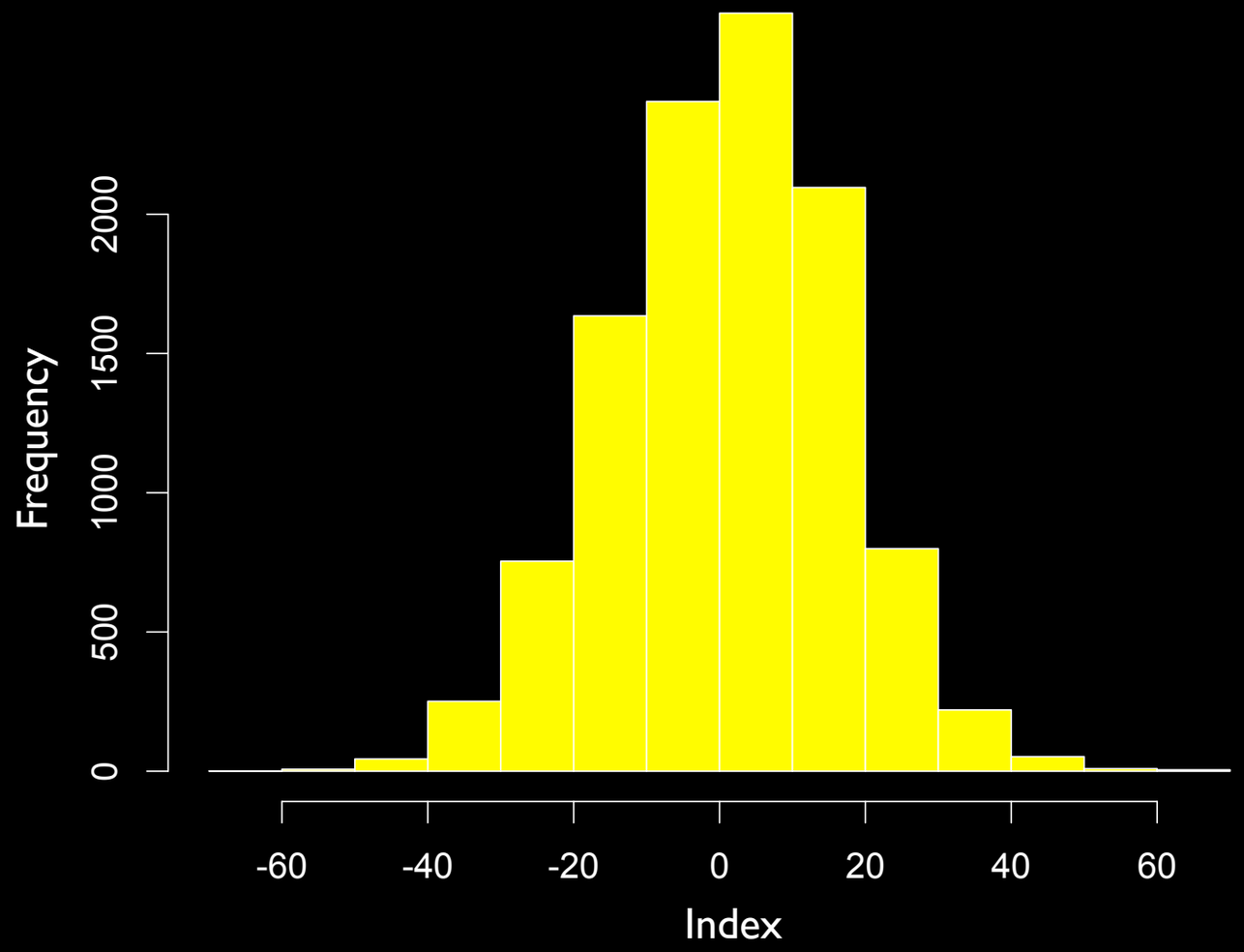

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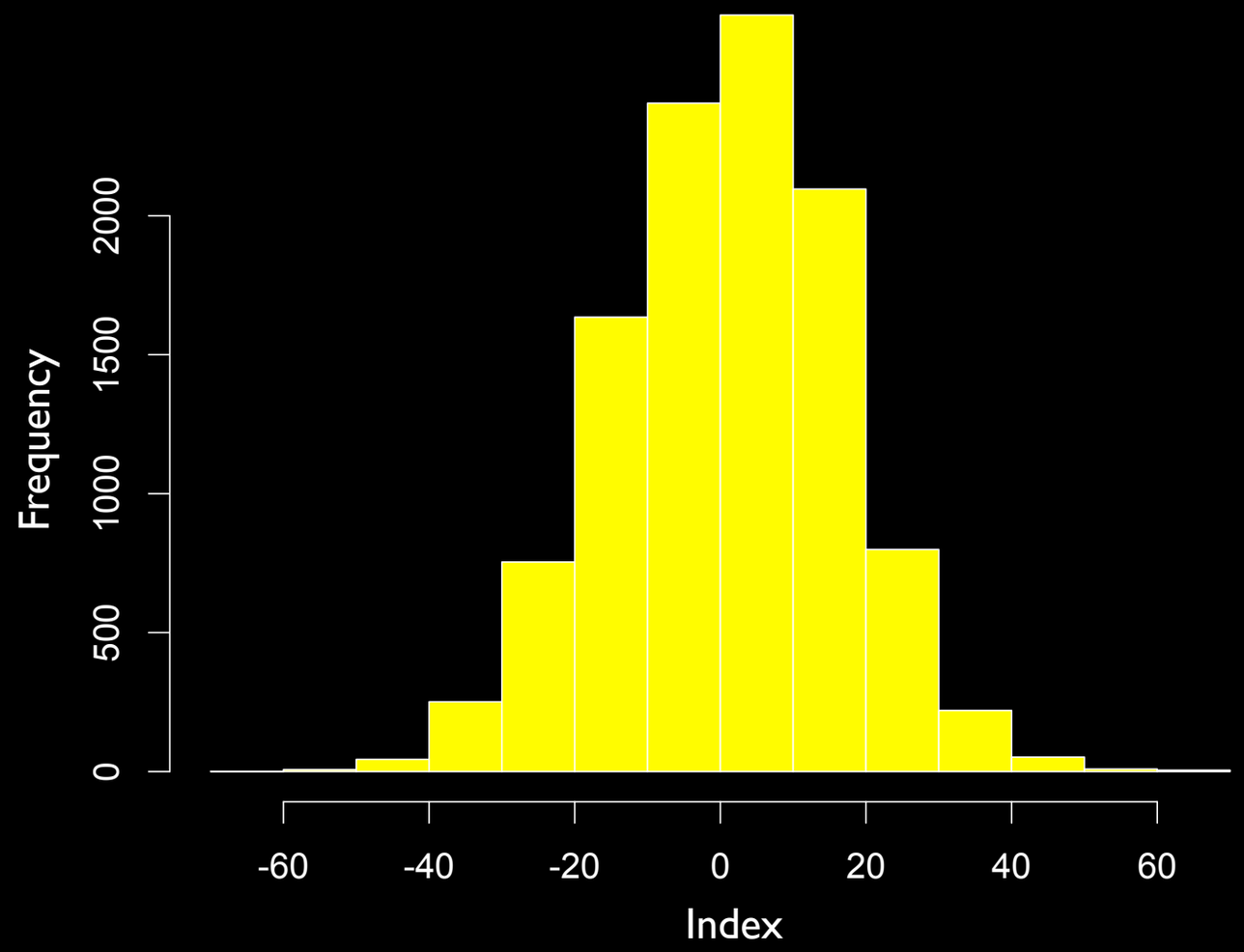

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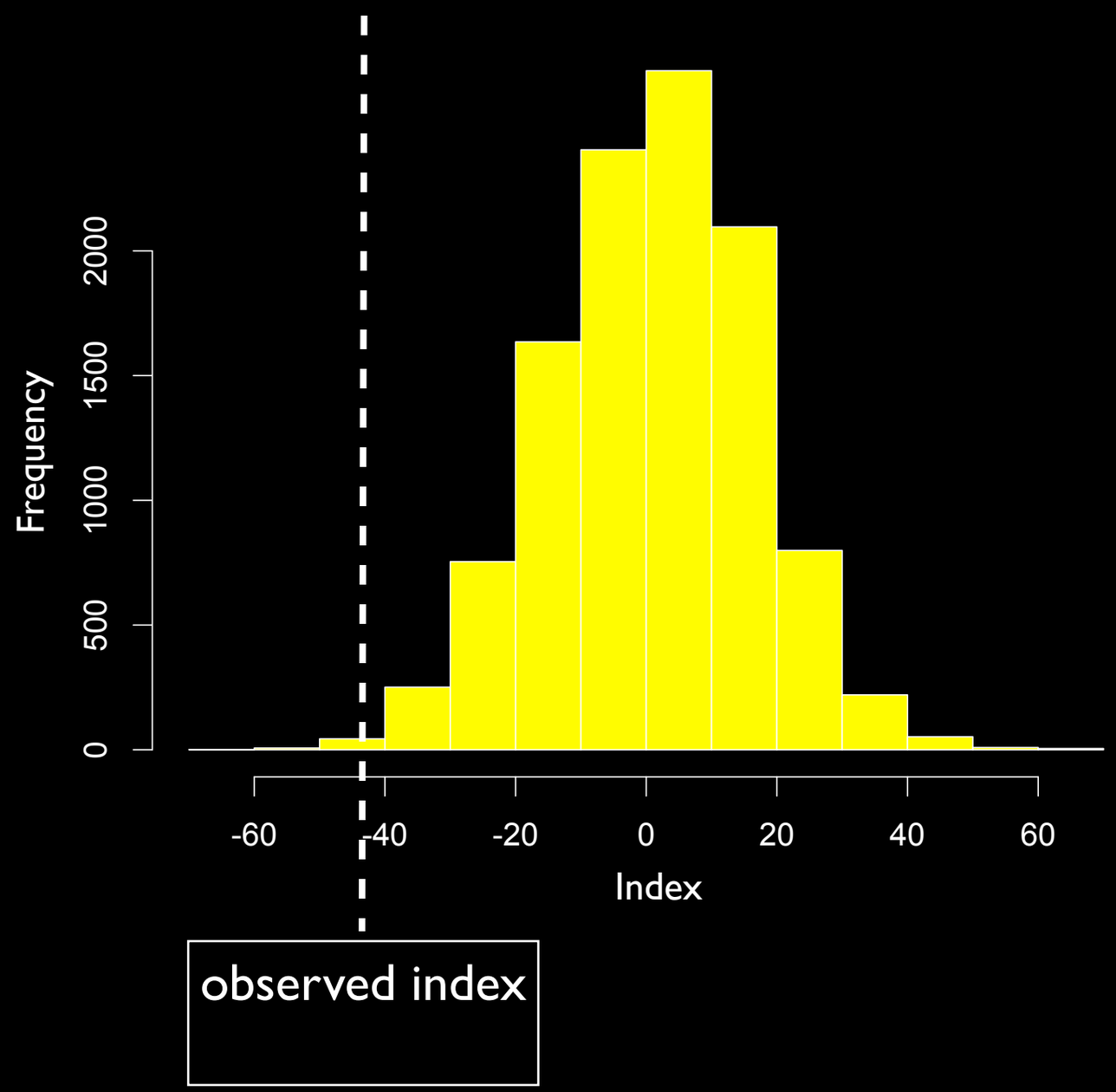

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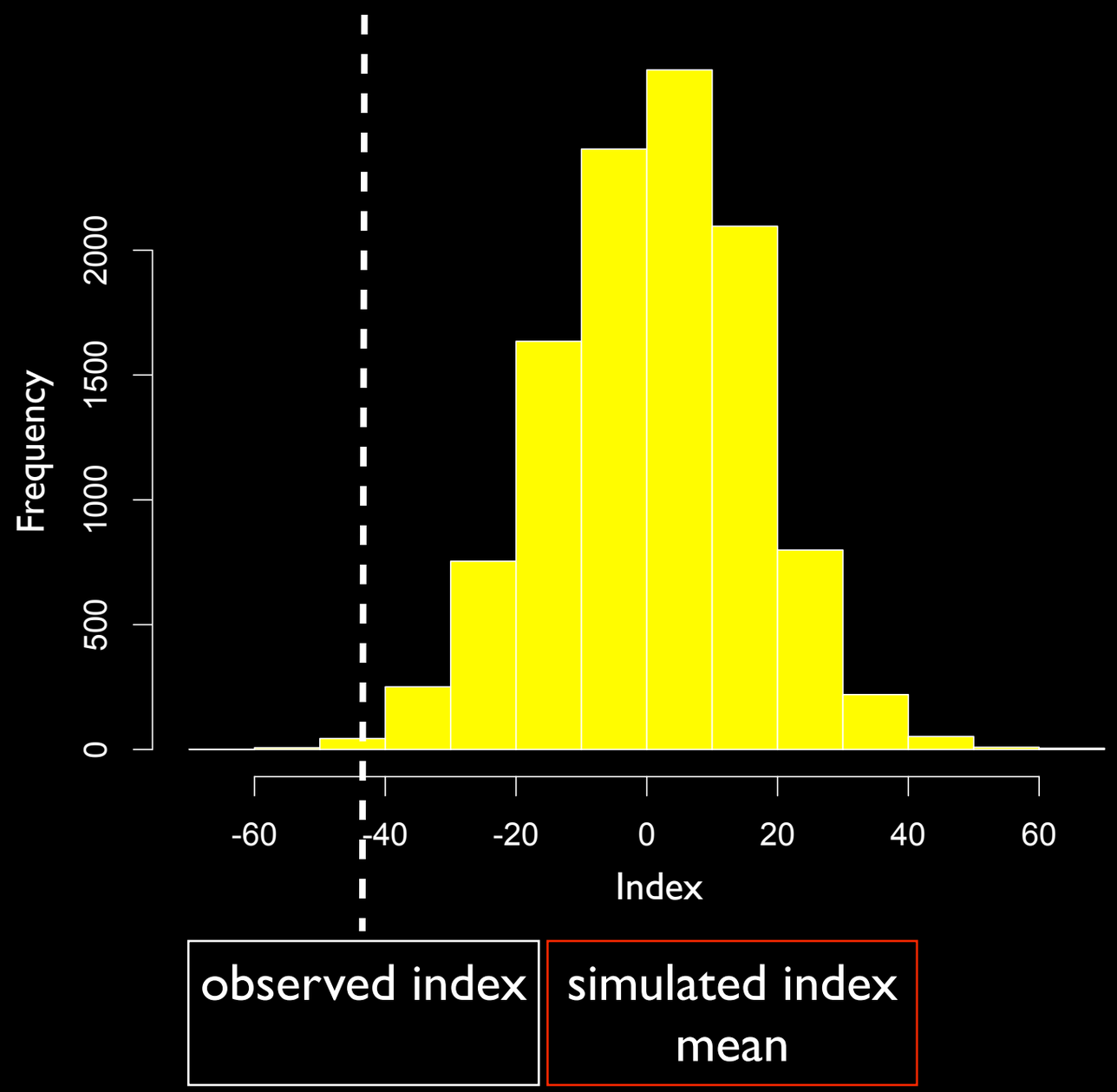

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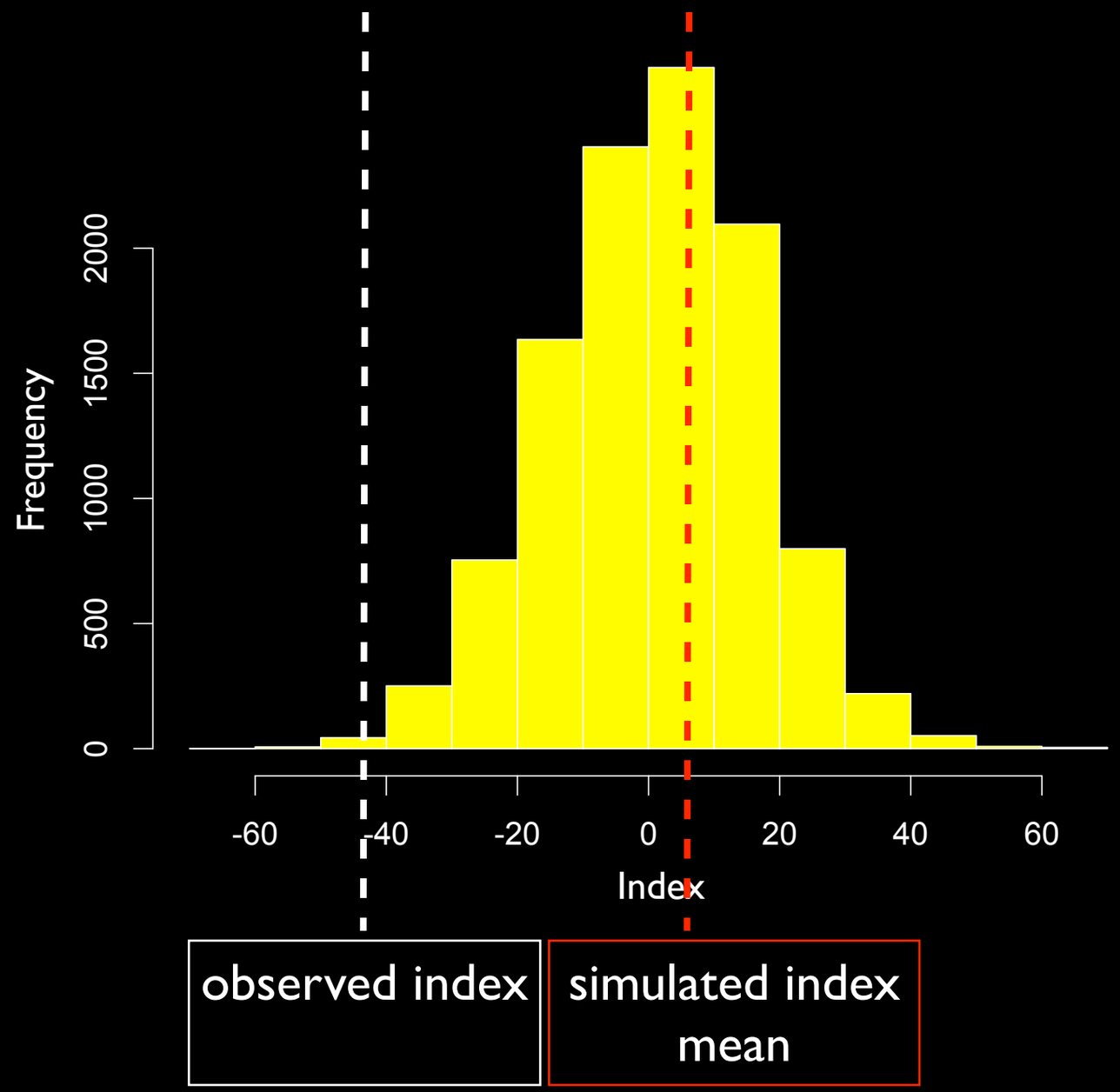

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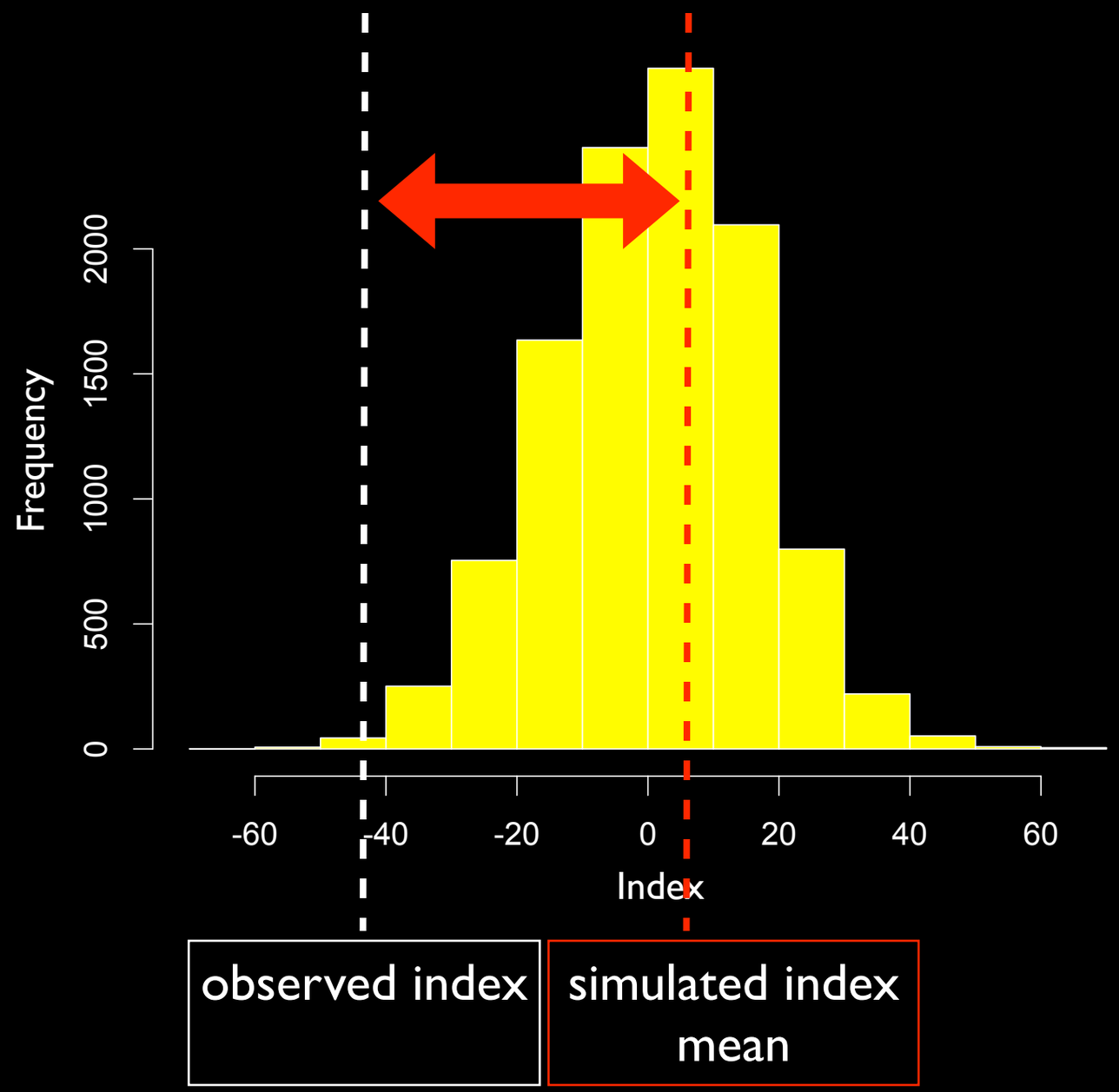

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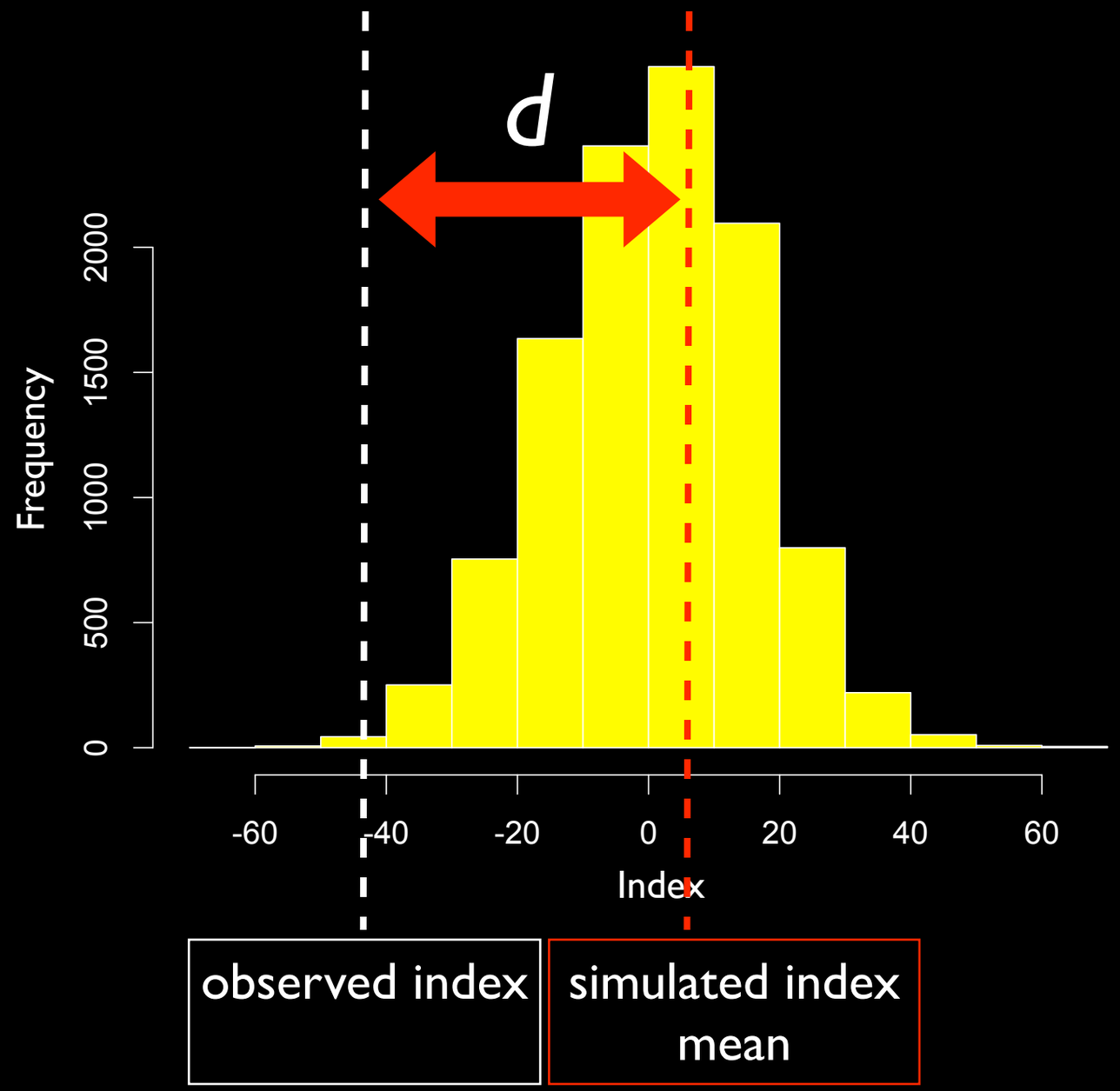

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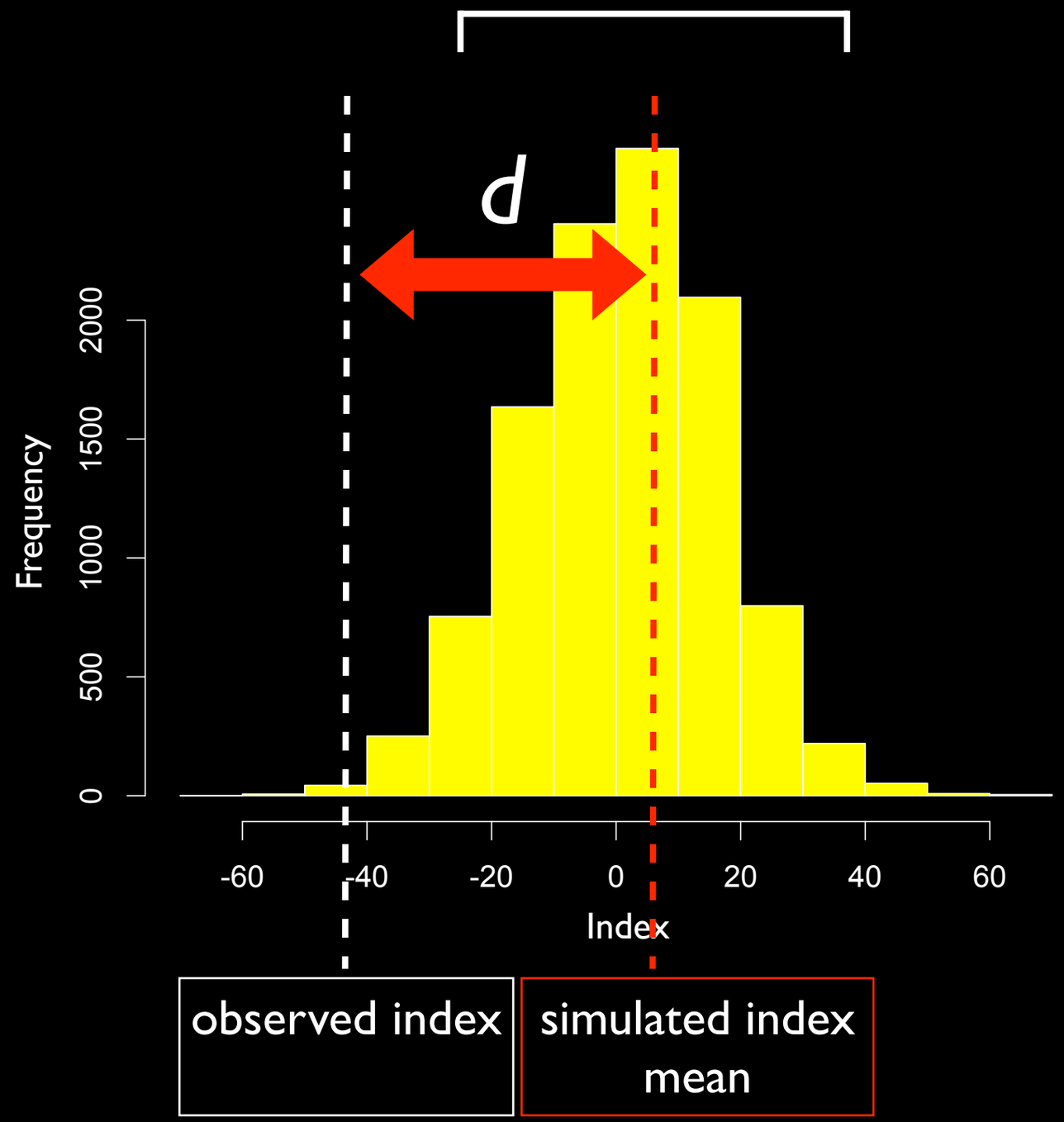

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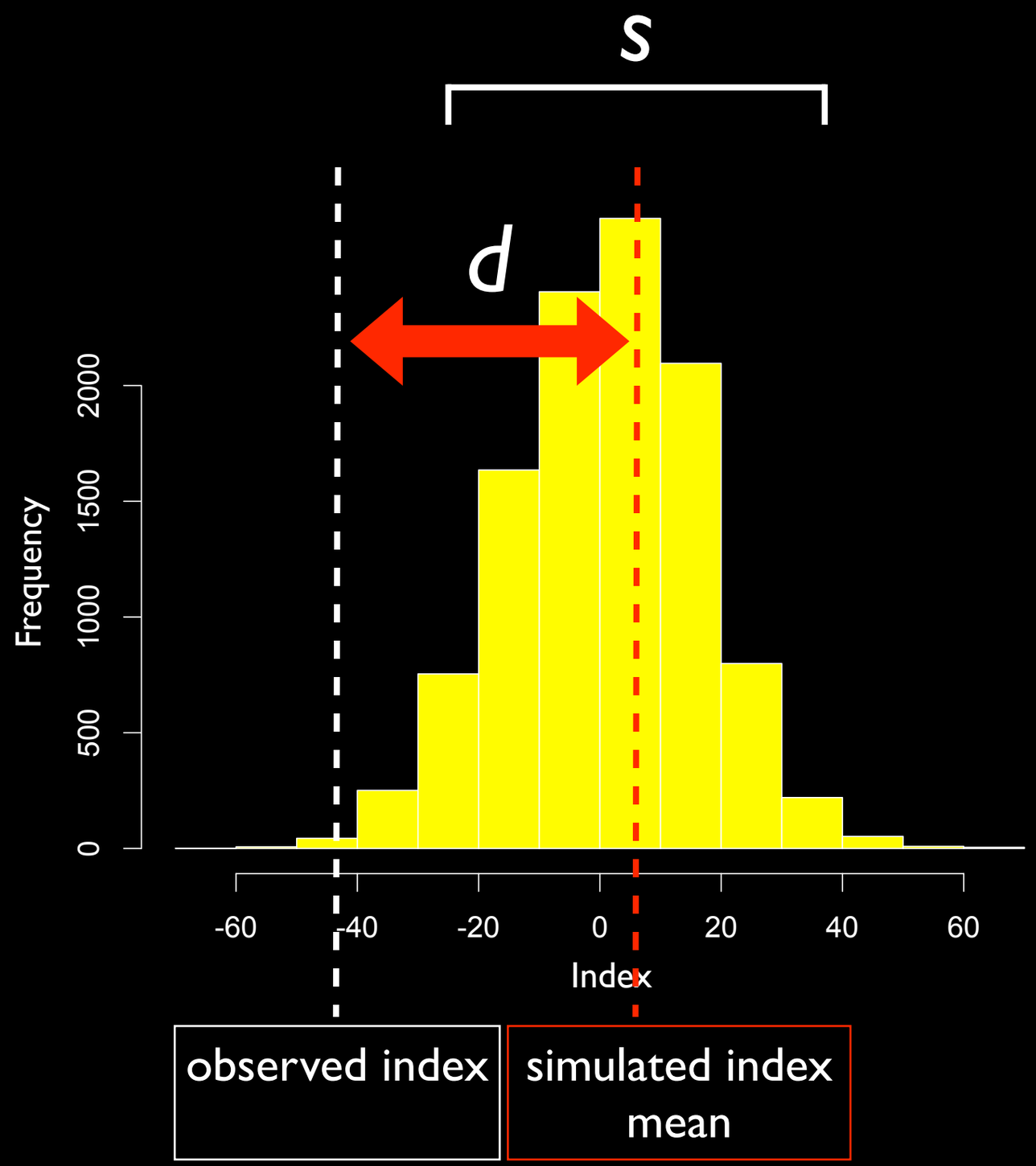

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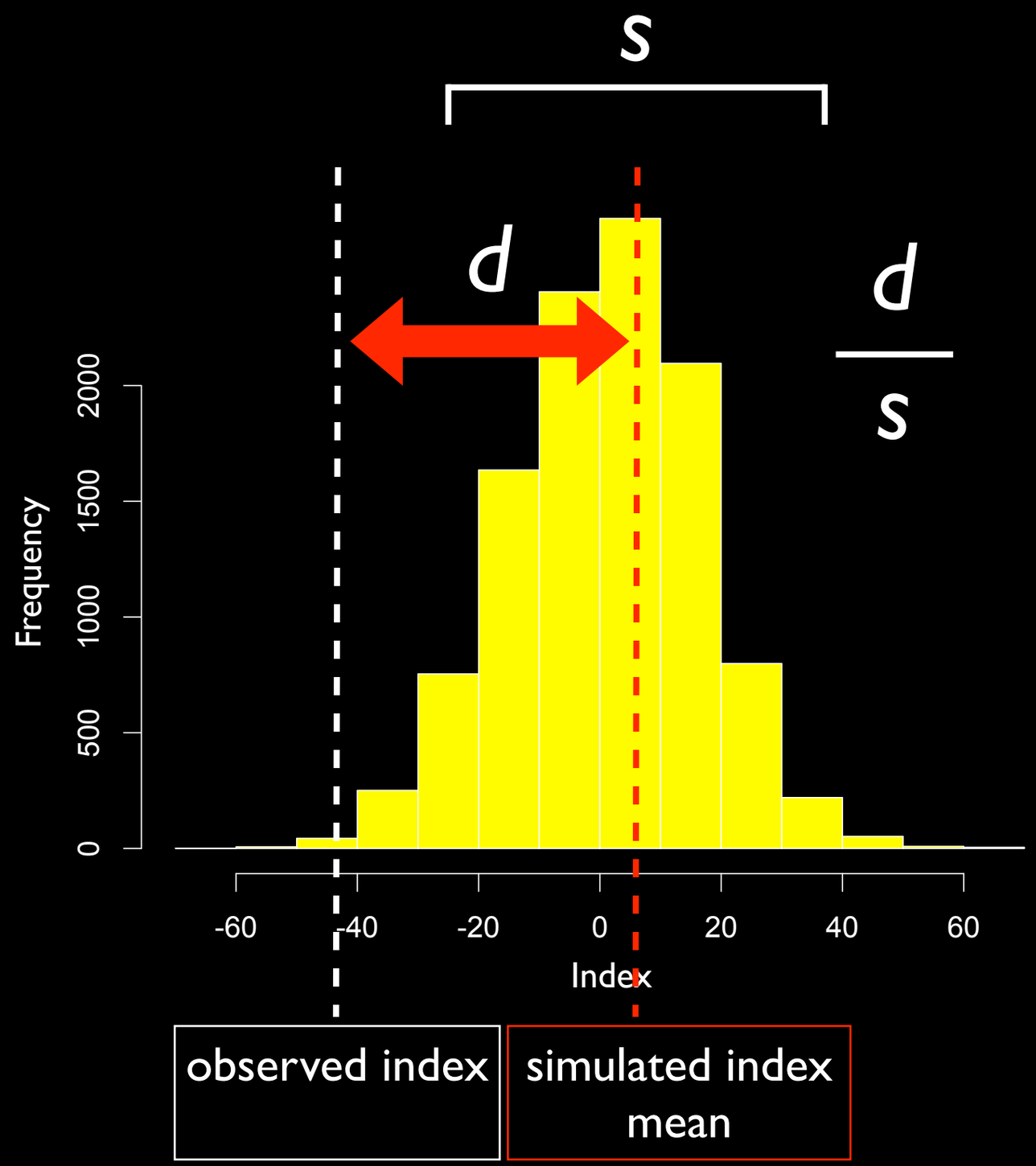

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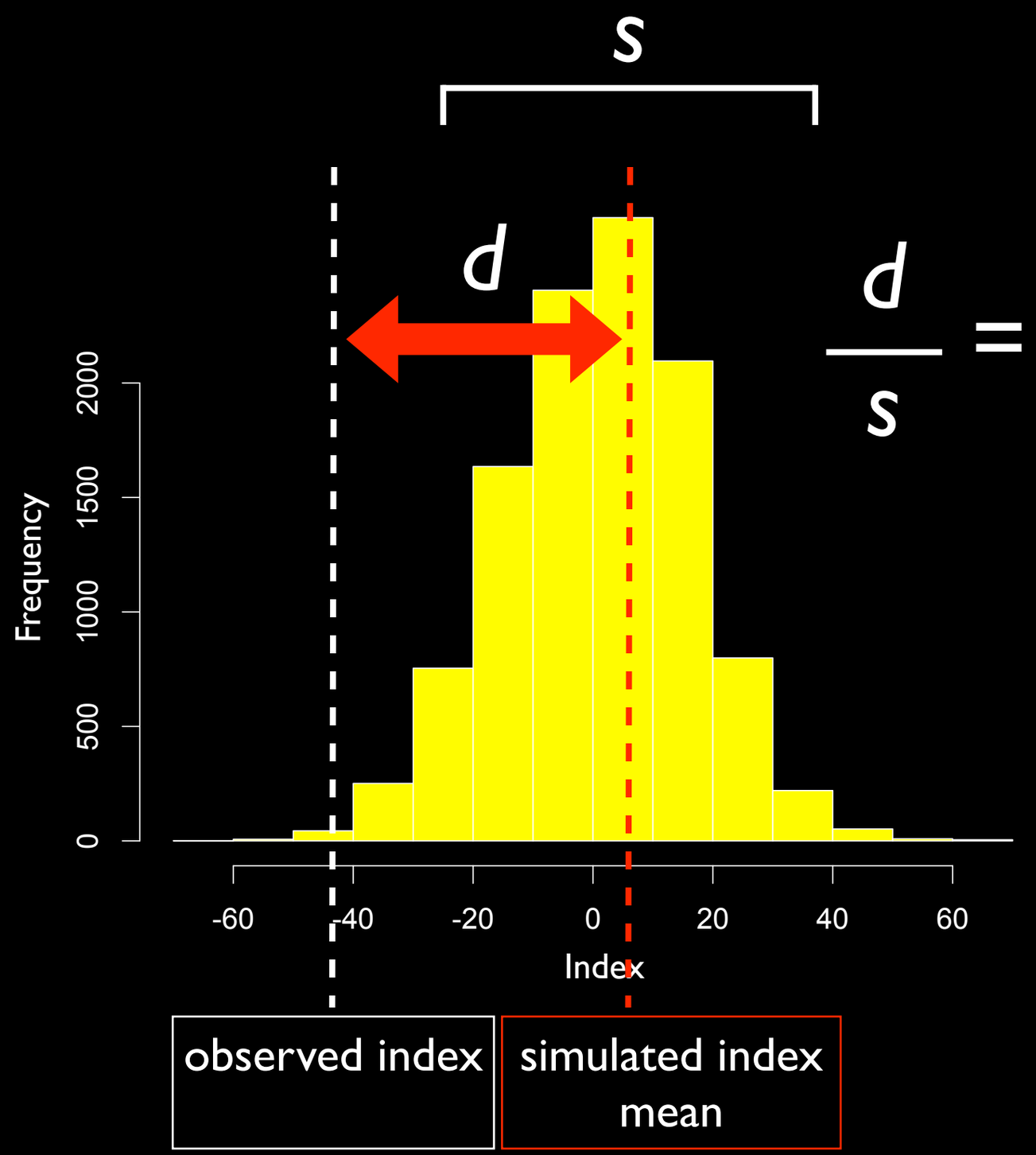

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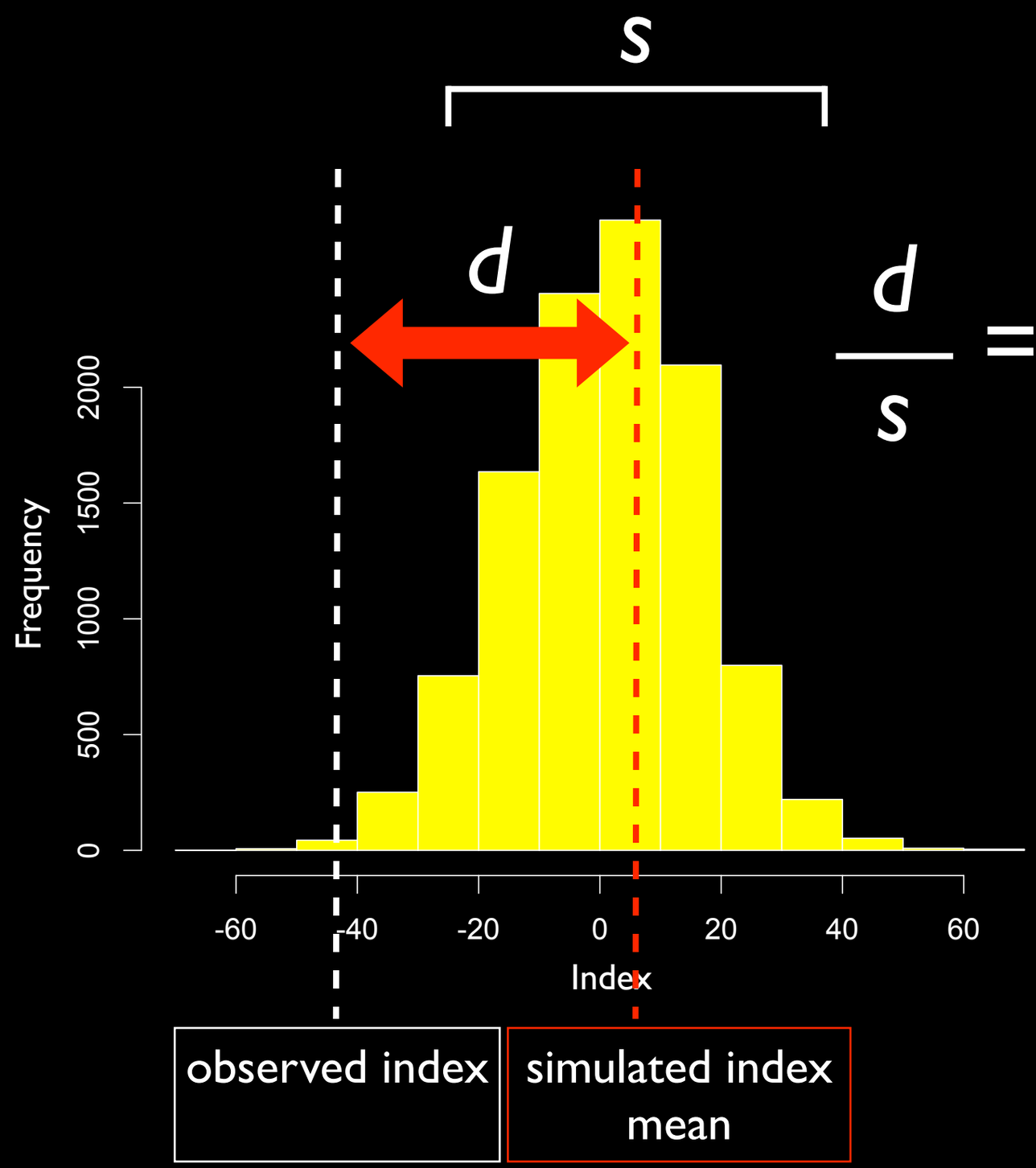

$$\frac{d}{s} = \text{Standardized Effect Size (SES)}$$

Co-occurrence Analysis

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SES

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SES 0 Random

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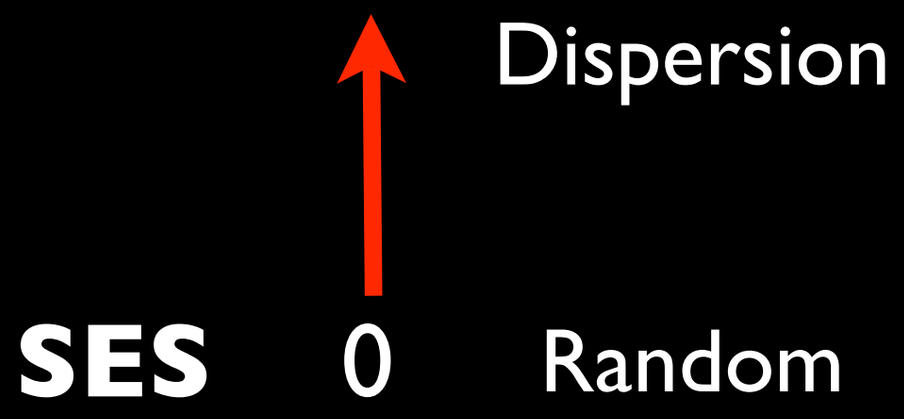

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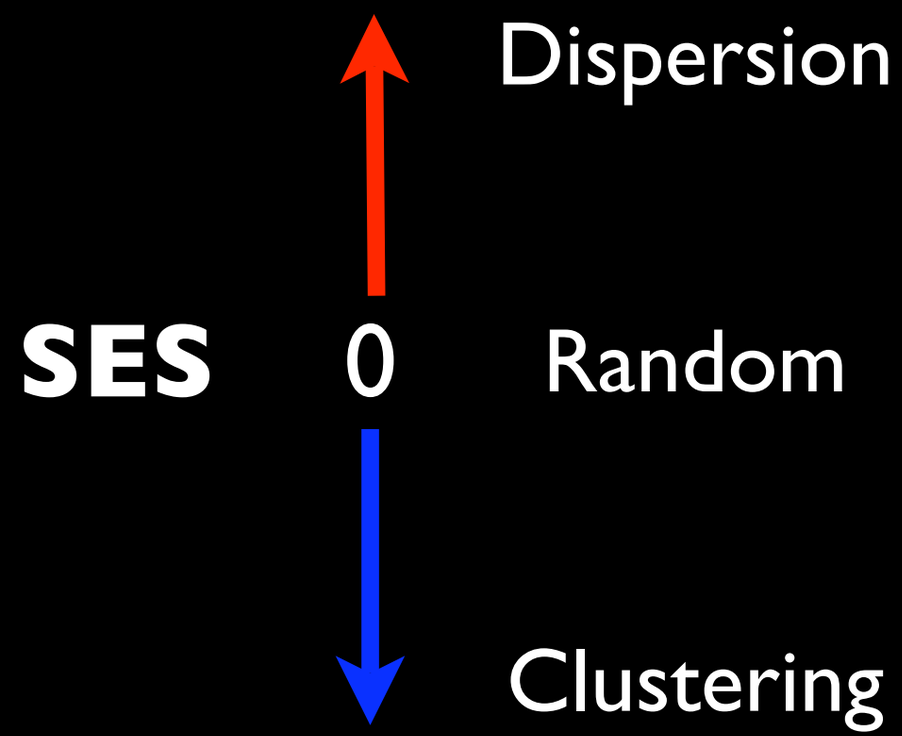
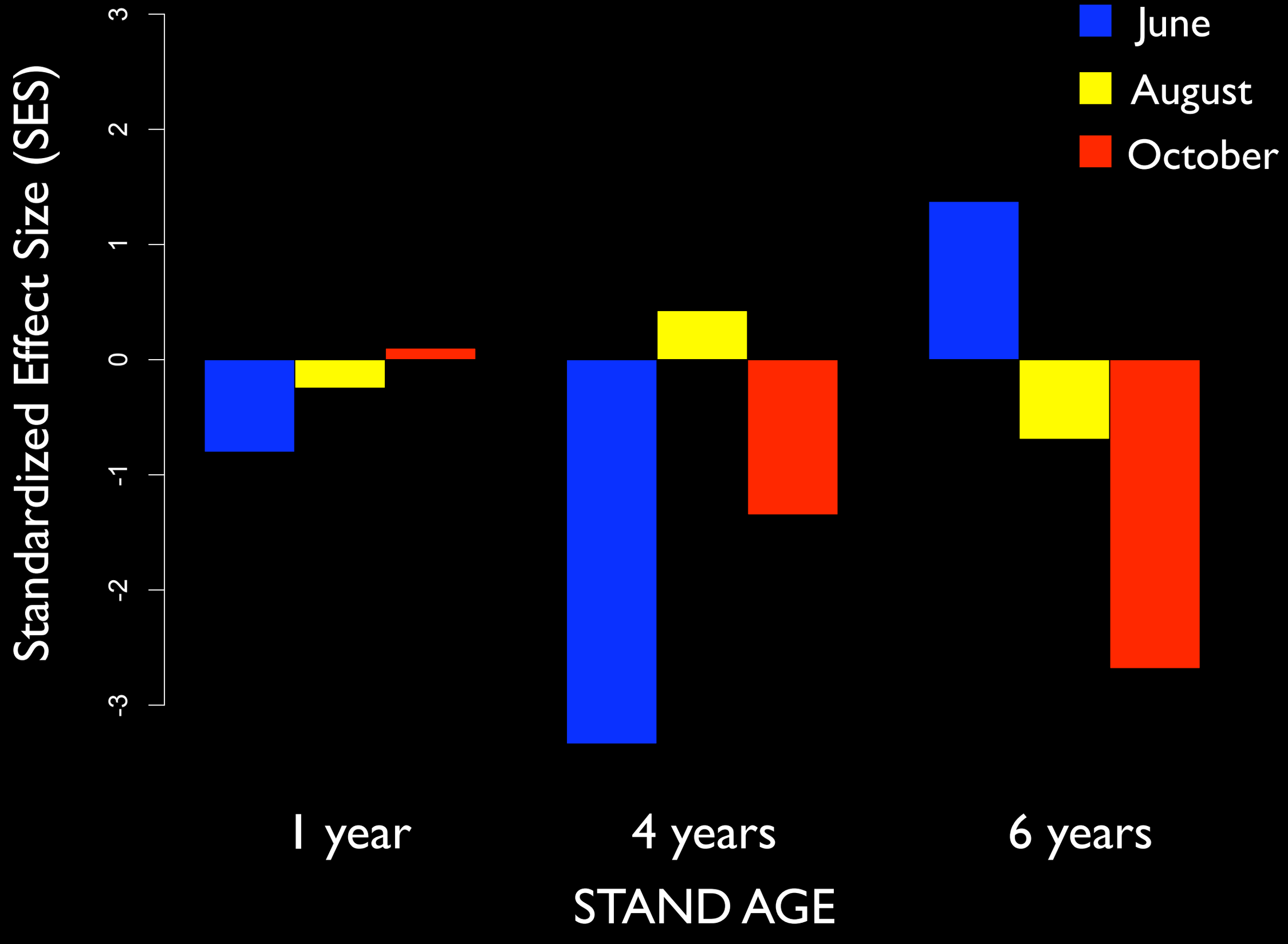
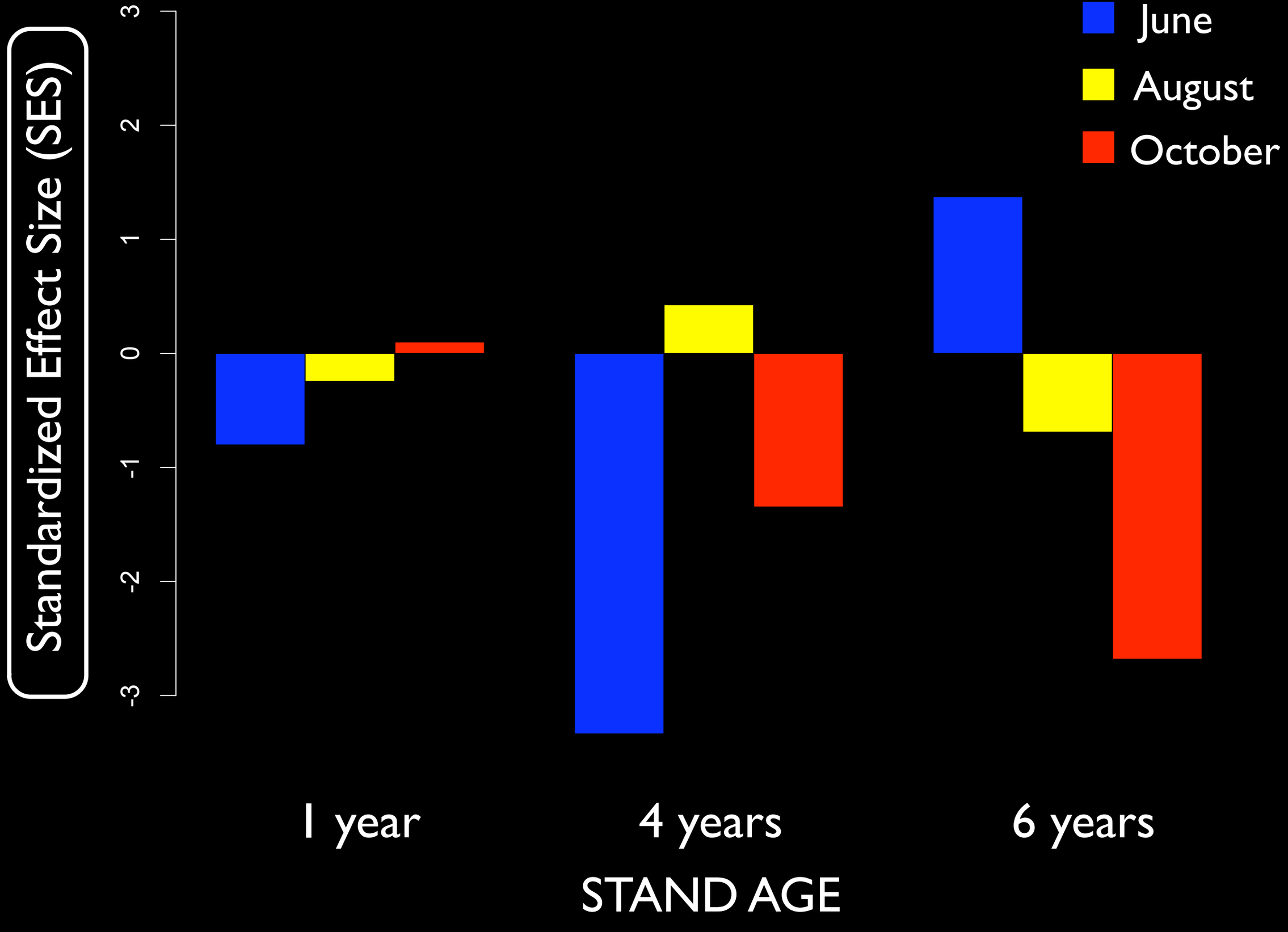


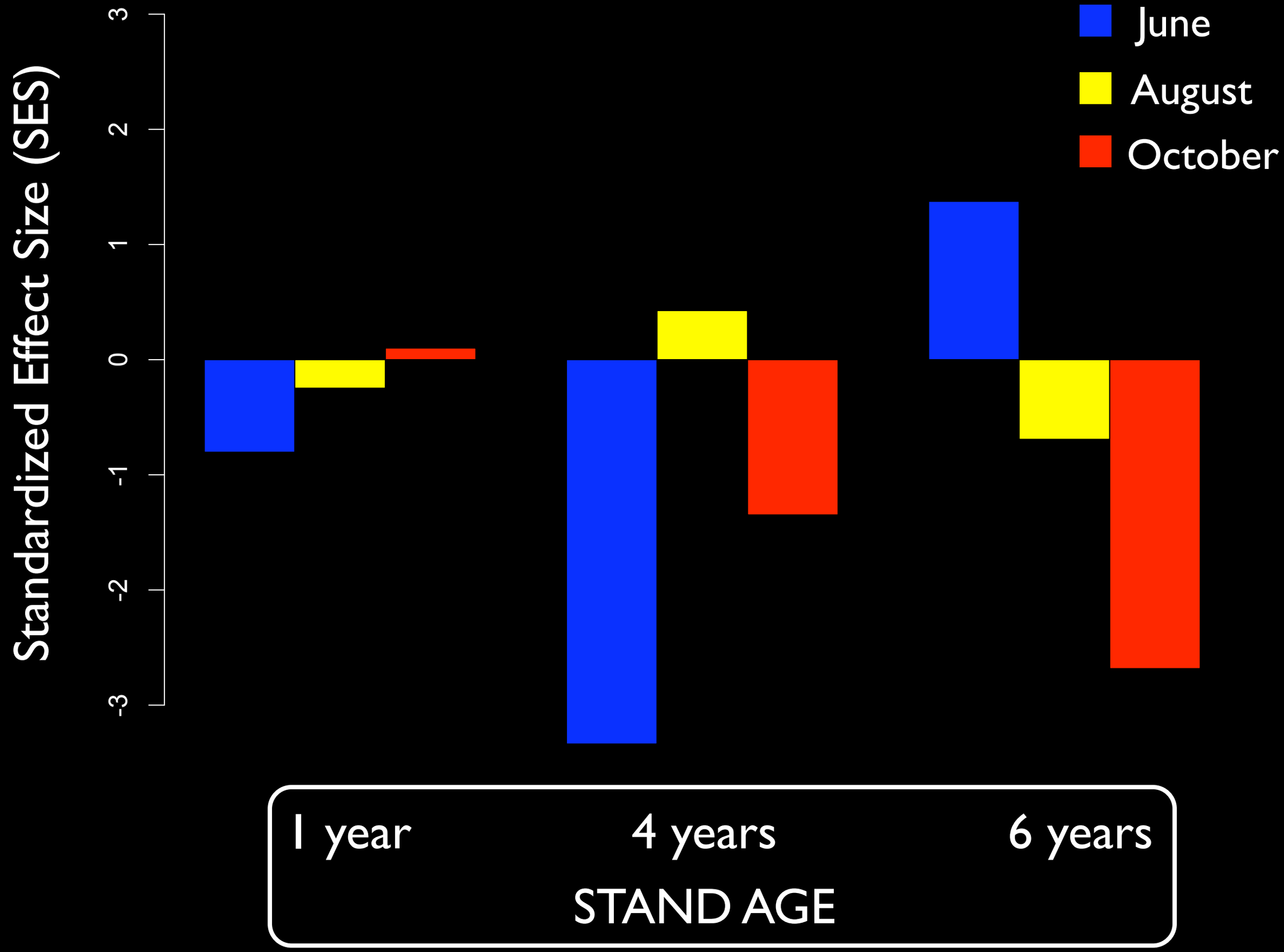
Results


Month
June
August
October
Standardized Effect Size (SES)
3
2
1
0
-1
-2
-3
1 year
4 years
6 years
STAND AGE

Results


Month
June
August
October
Standardized Effect Size (SES)
3
2
1
0
-1
-2
-3
1 year
4 years
6 years
STAND AGE

Results


Month
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August
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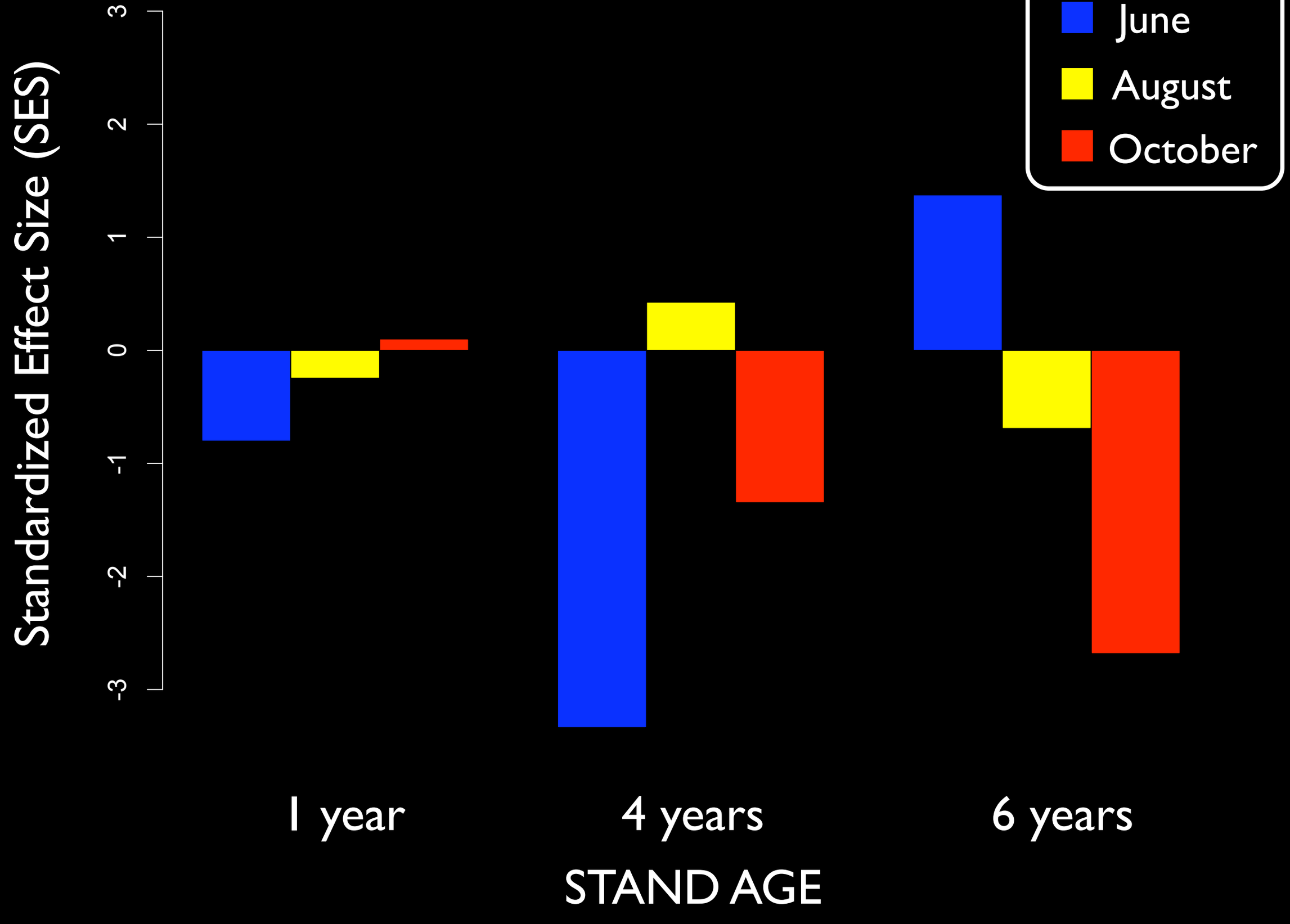
Results


Month
June
August
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Standardized Effect Size (SES)
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2
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1 year
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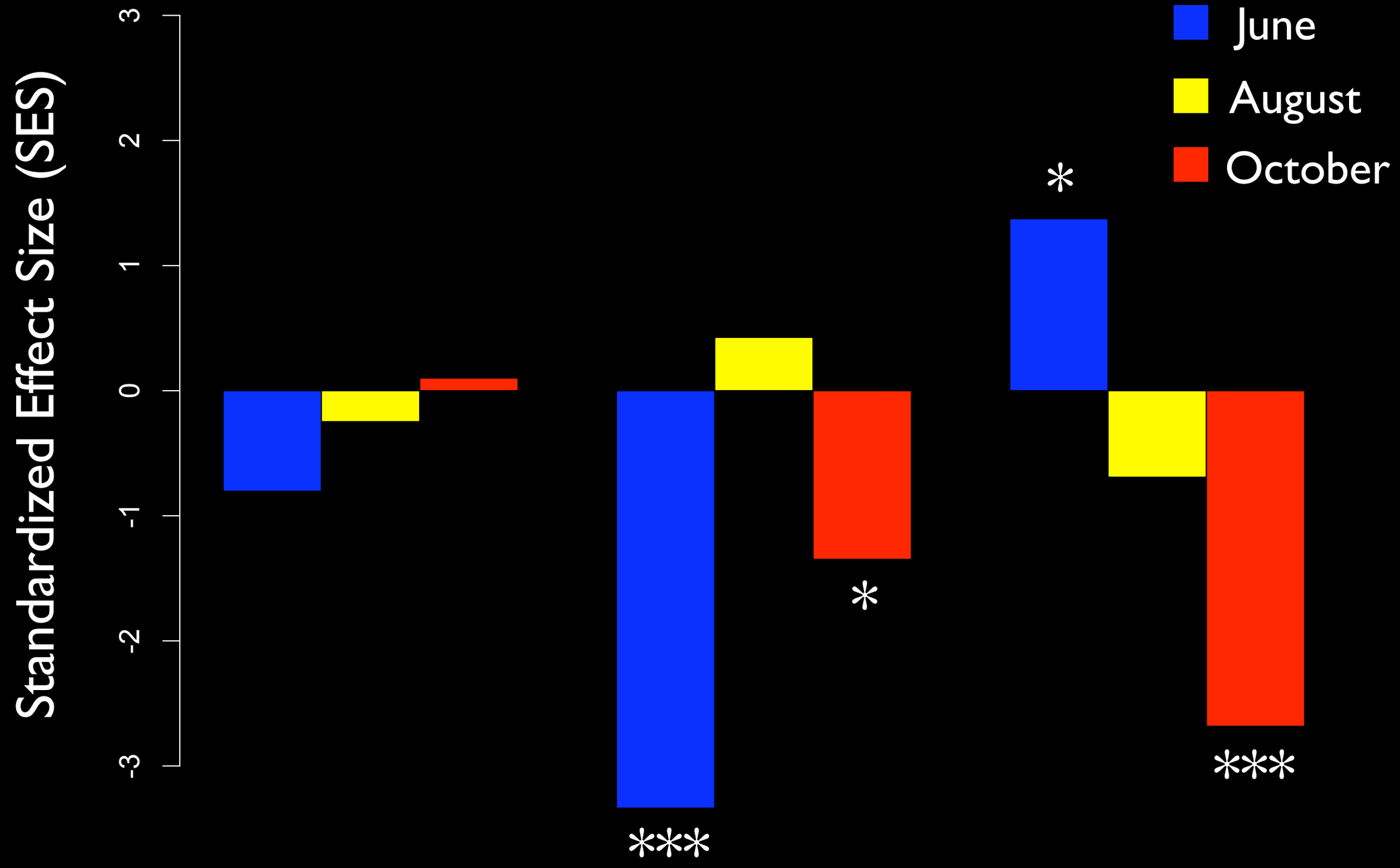
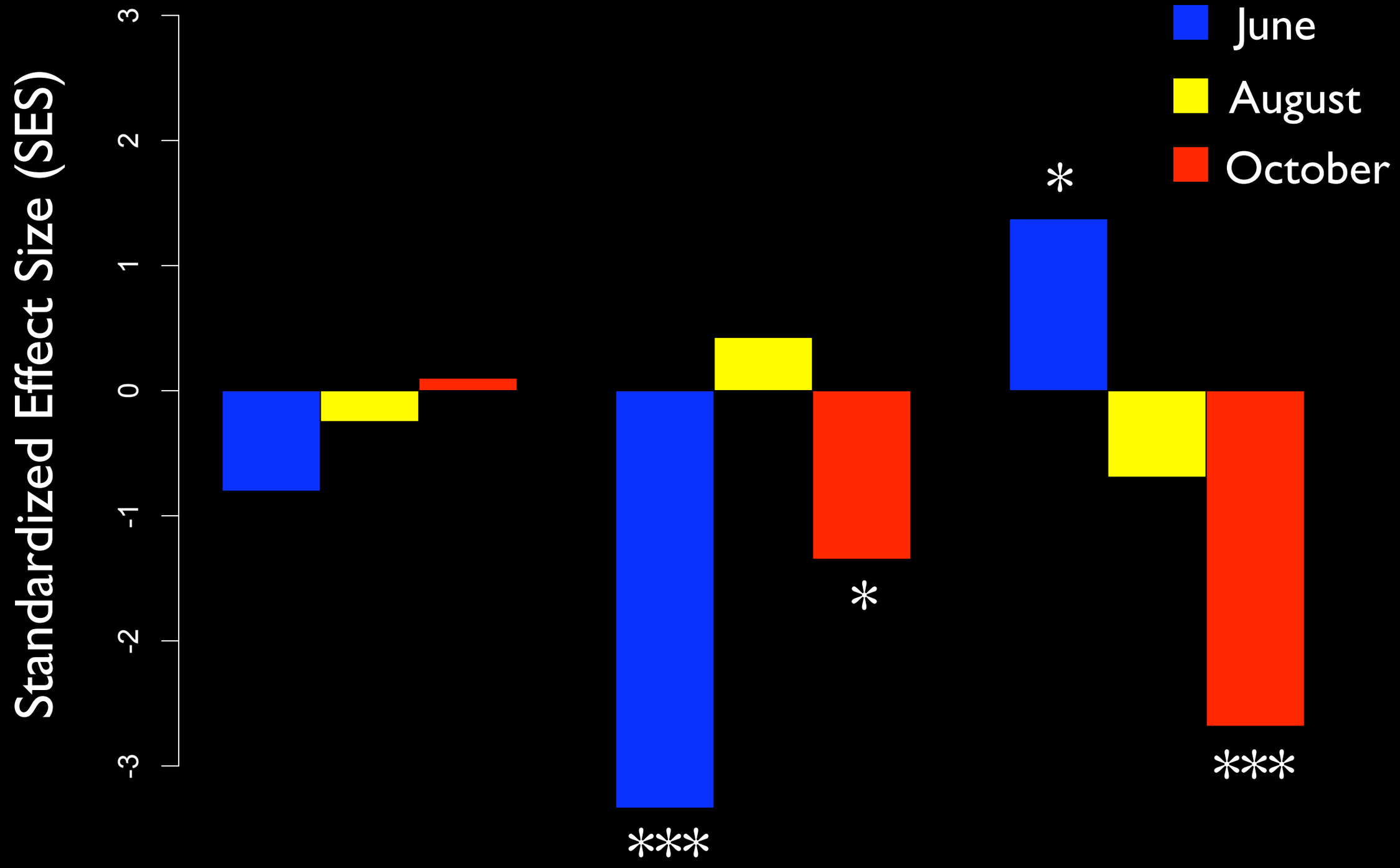
6 years
STAND AGE

Results

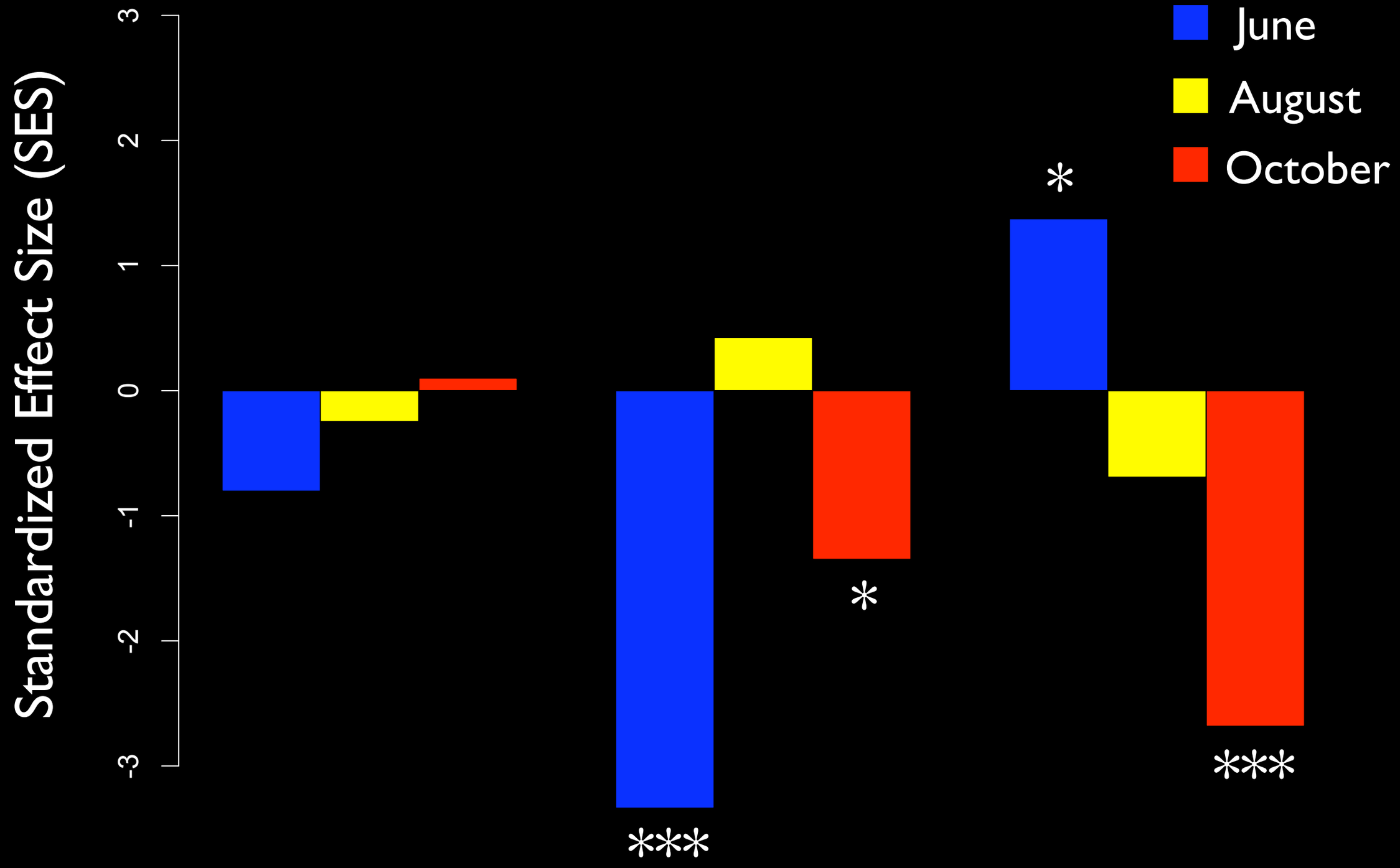

Month
June
August
October
Standardized Effect Size (SES)
3
2
1
0
-1
-2
-3
*
*
***
***
1 year
4 years
6 years
STAND AGE

Results



P-value: * < 0.10, *** < 0.01

Results



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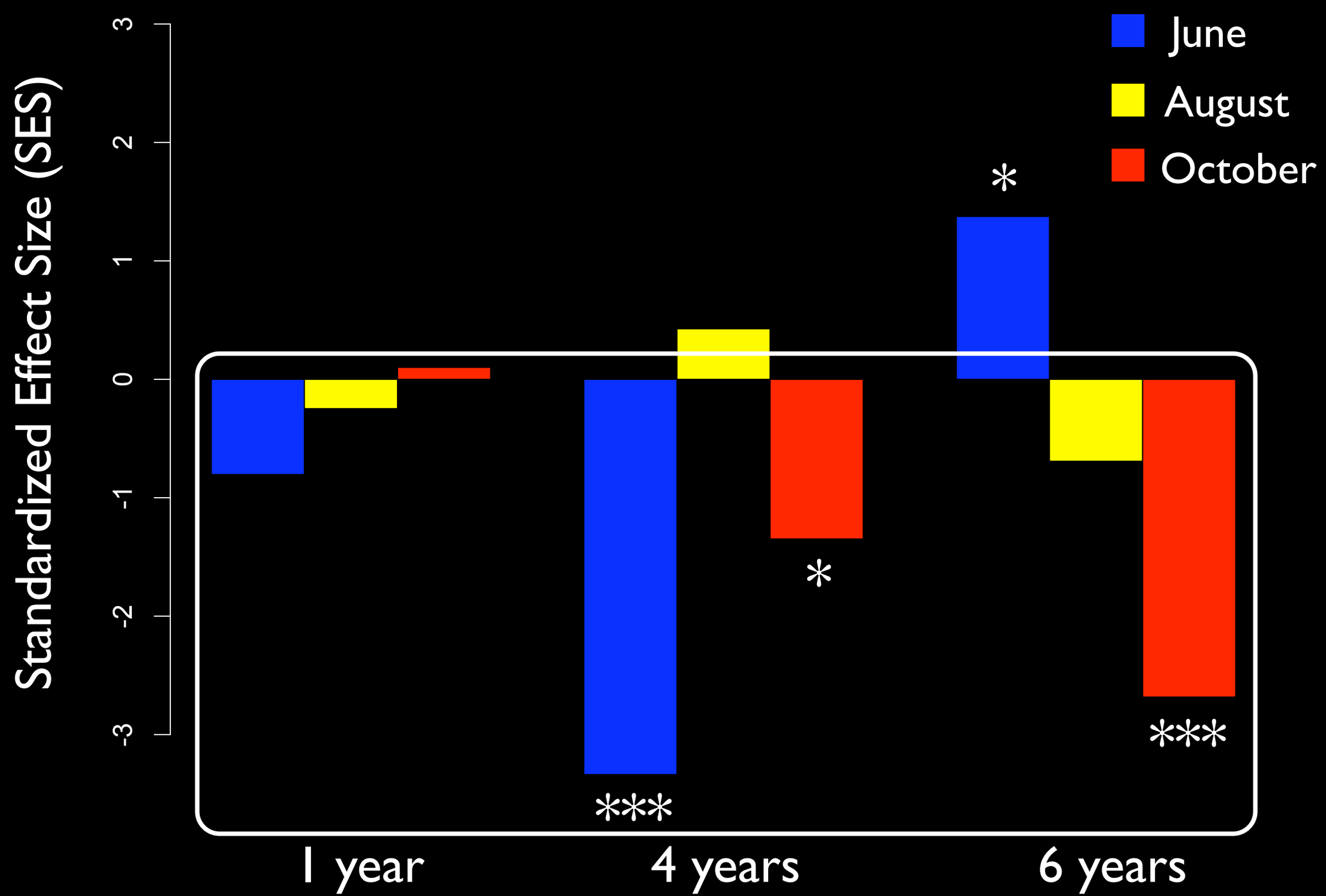
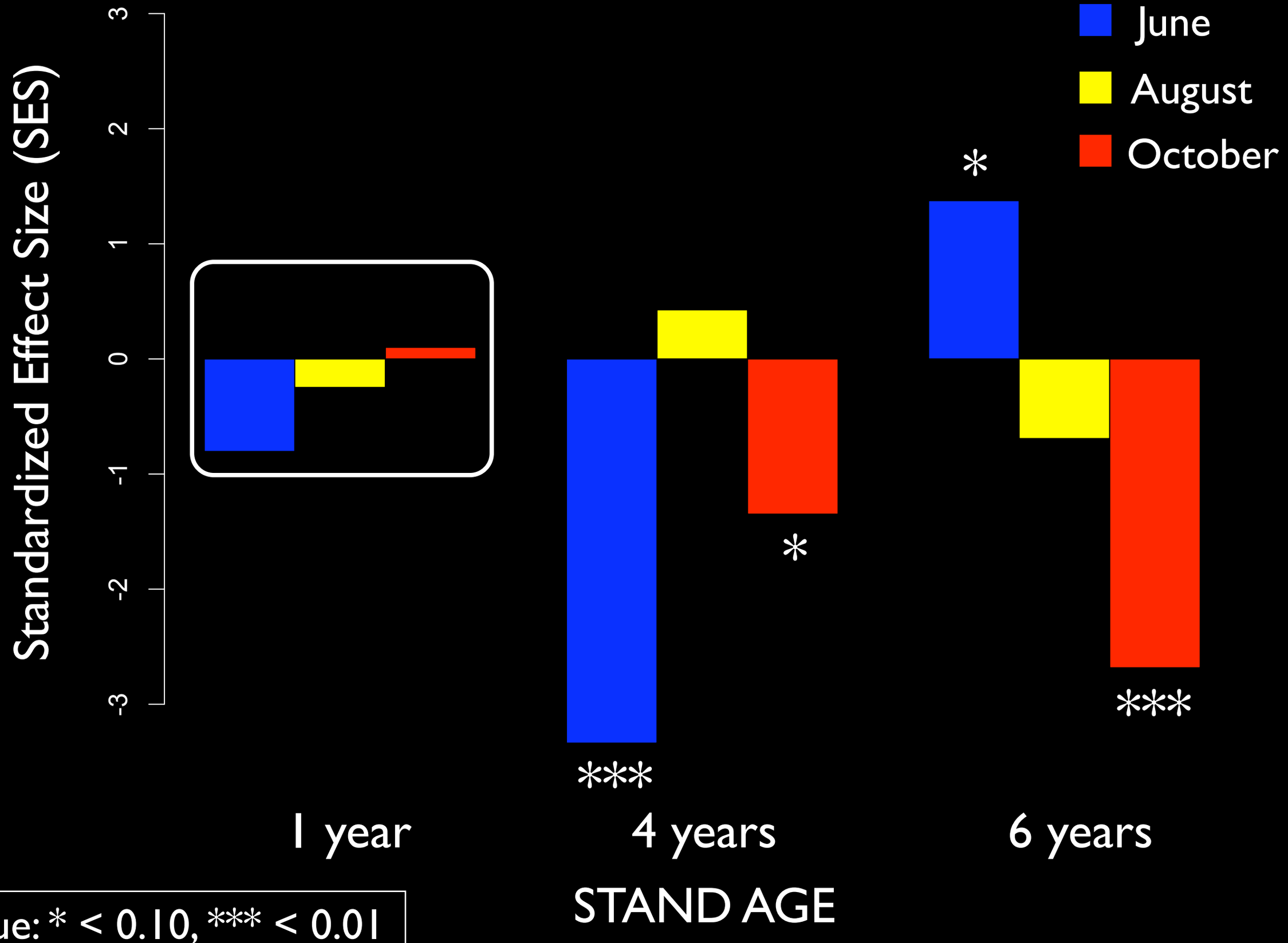


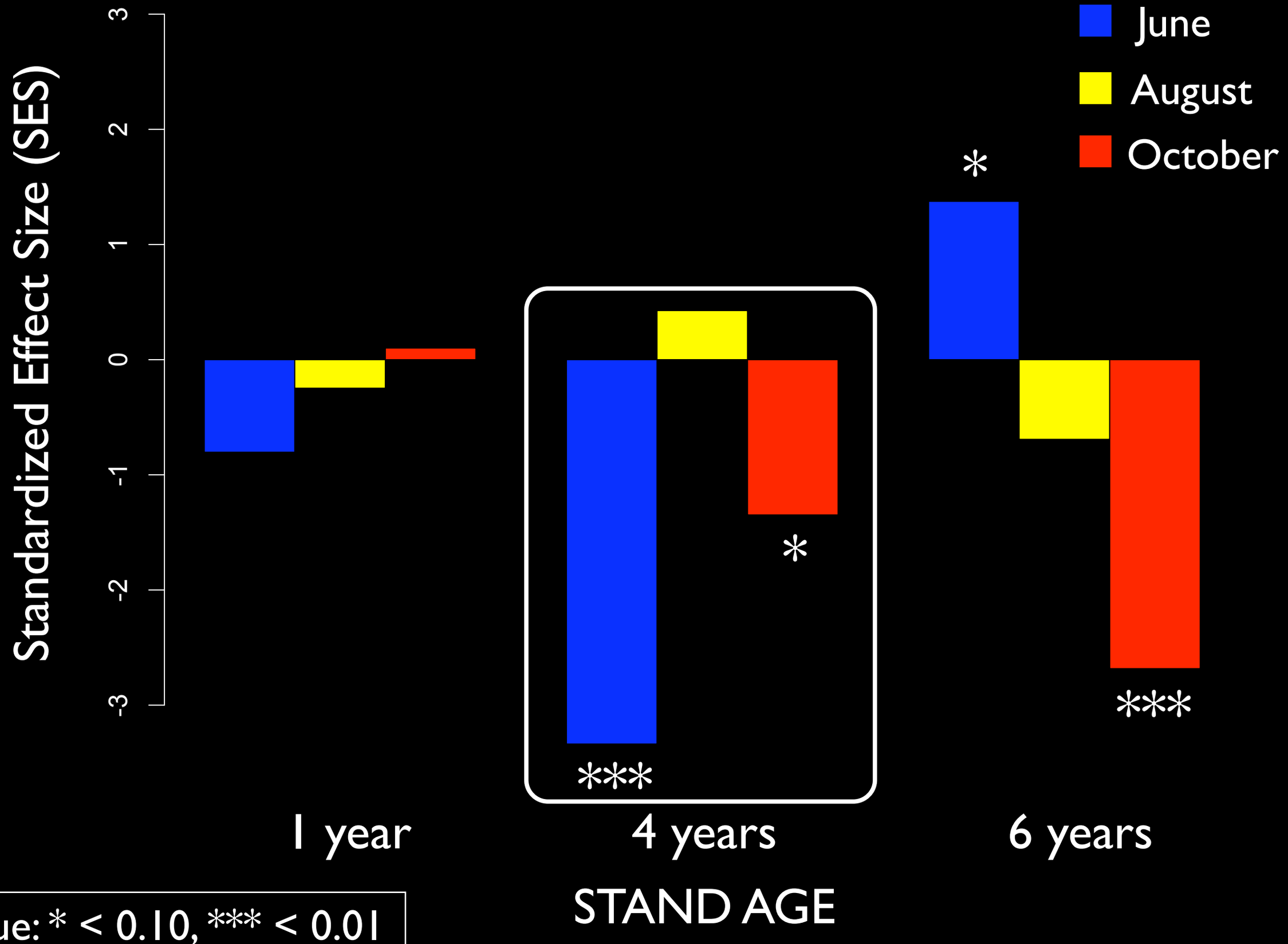
P-value: * < 0.10, *** < 0.01

Results



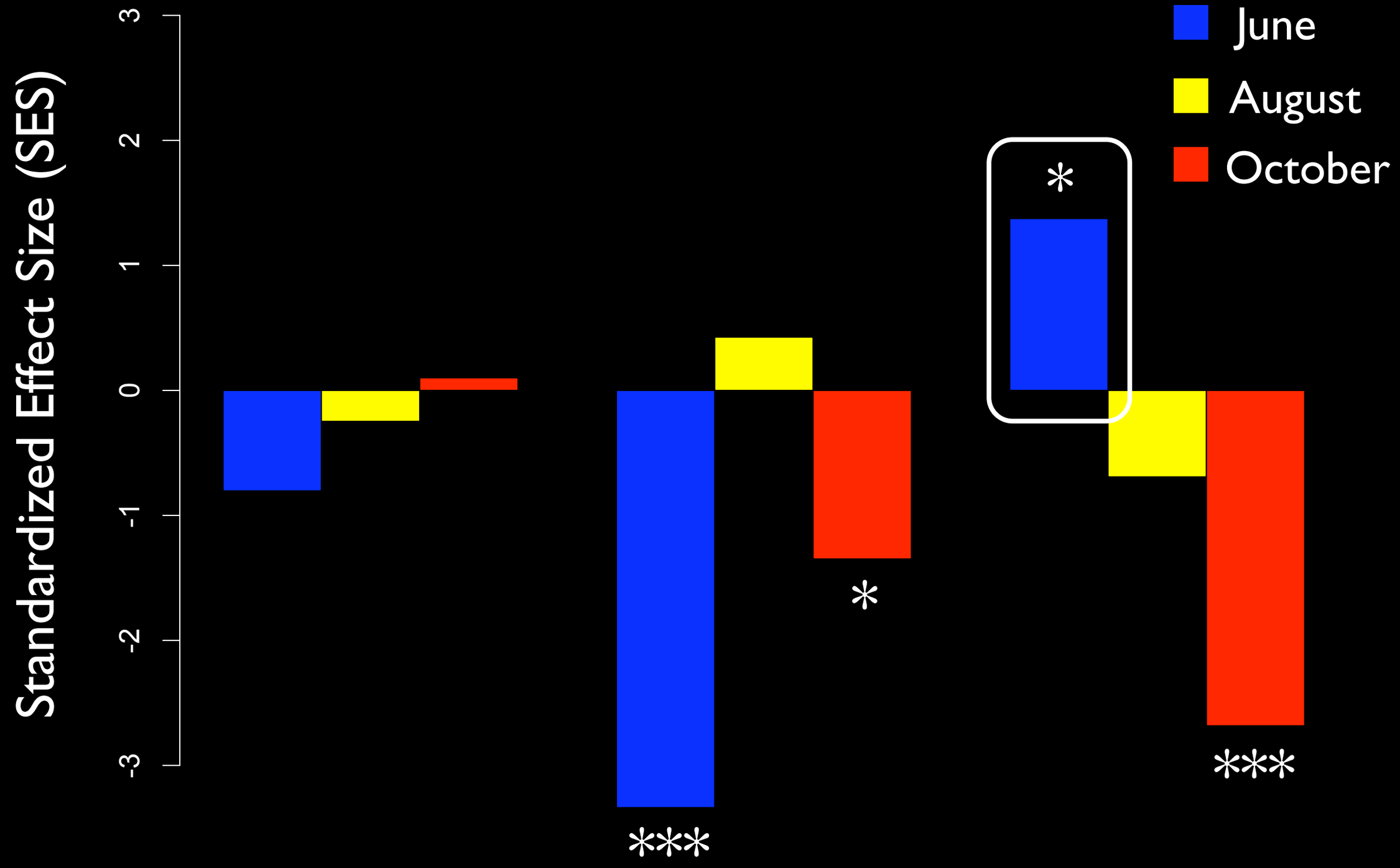
P-value: * < 0.10, *** < 0.01

Results



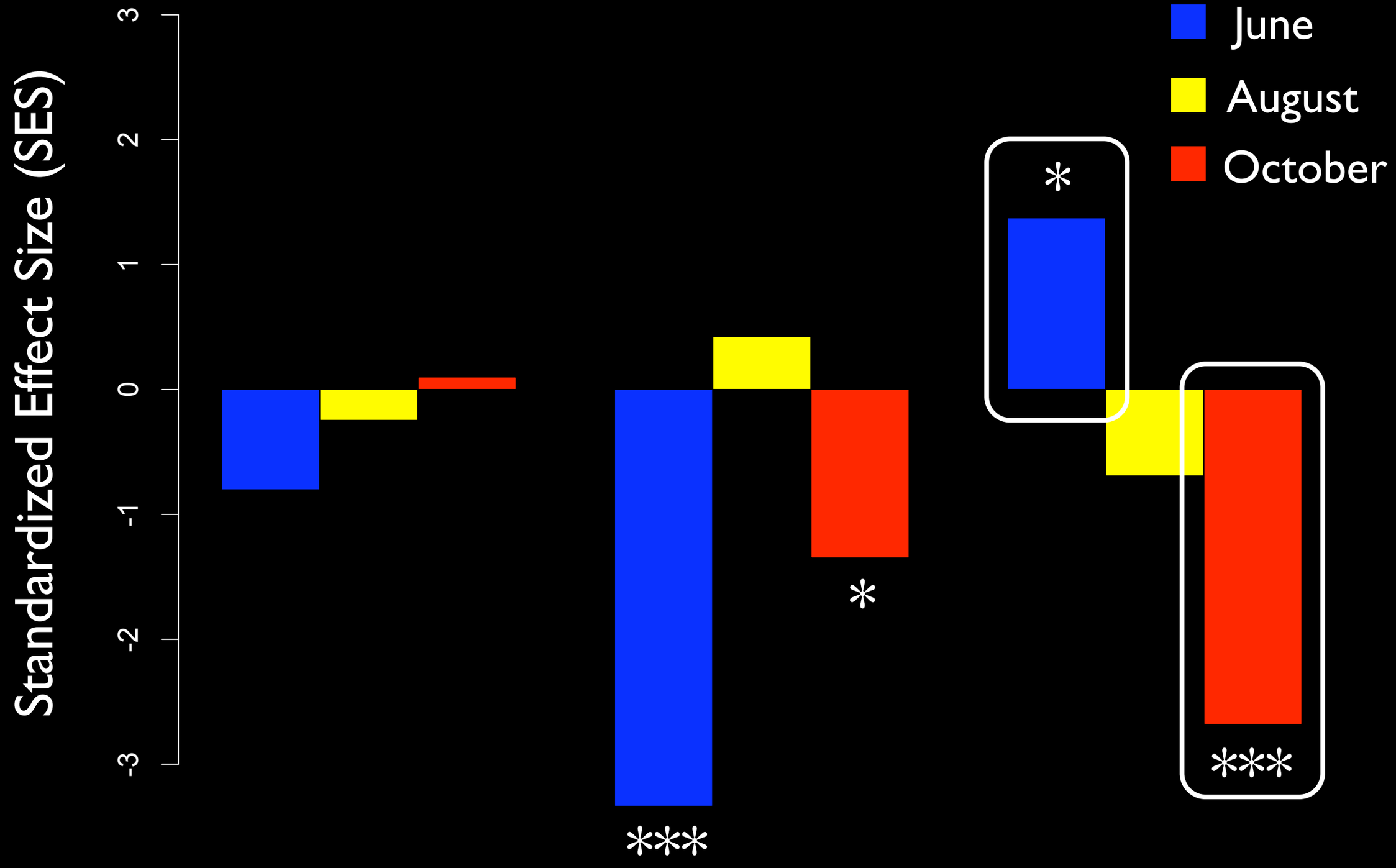
P-value: * < 0.10, *** < 0.01

Results



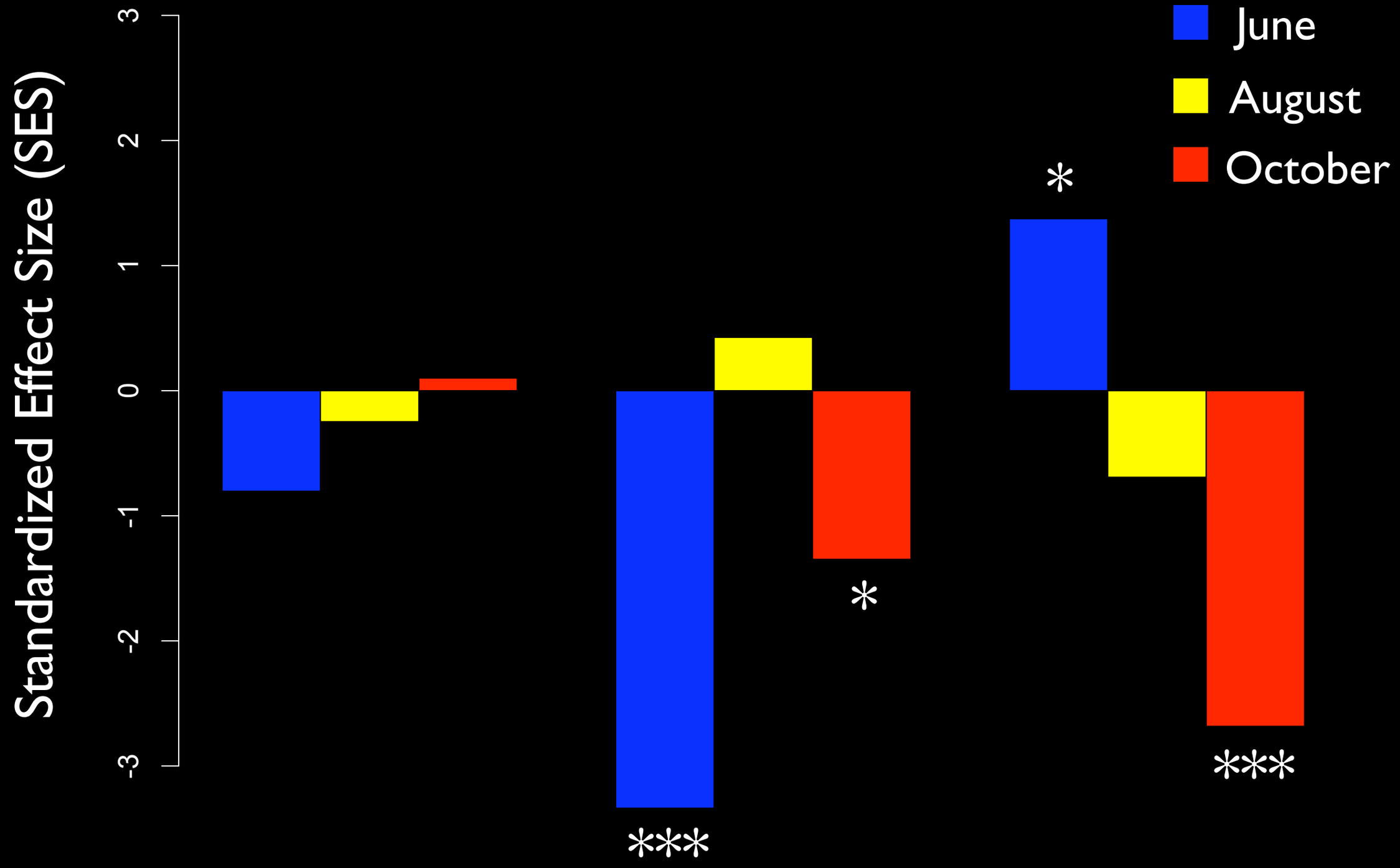
P-value: * < 0.10, *** < 0.01

Results



P-value: * < 0.10, *** < 0.01

Results



P-value: * < 0.10, *** < 0.01

Results

Results

- Richness and diversity consistent from stand to stand and month to month

Results

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- Community composition varied by month and stand

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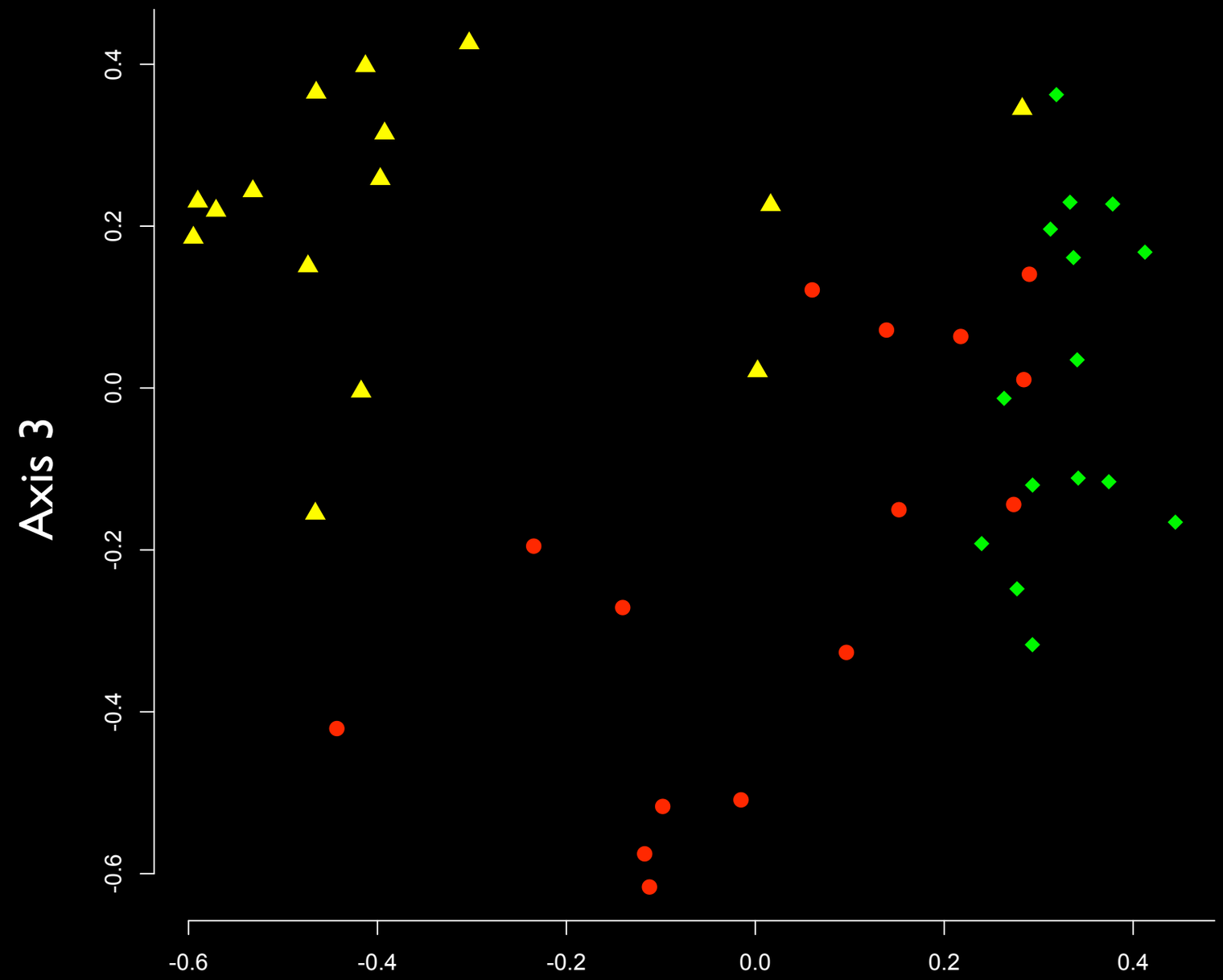
- Community composition varied by month and stand

PerMANOVA:
month*stand P < 0.001 *

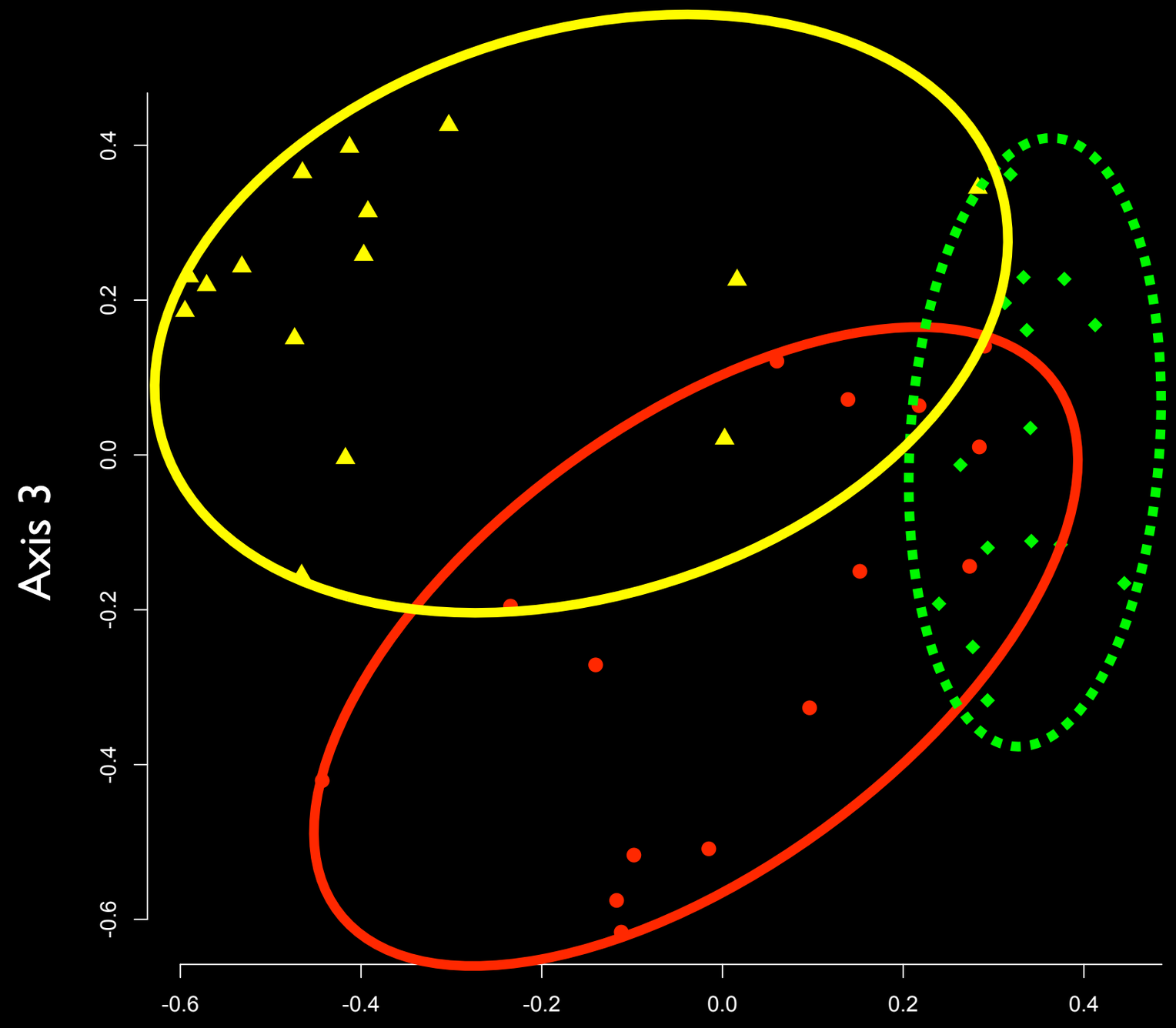
October

Stand Age
- 1 year
- 4 years
- 6 years



PerMANOVA:
month*stand P < 0.001 ***

October



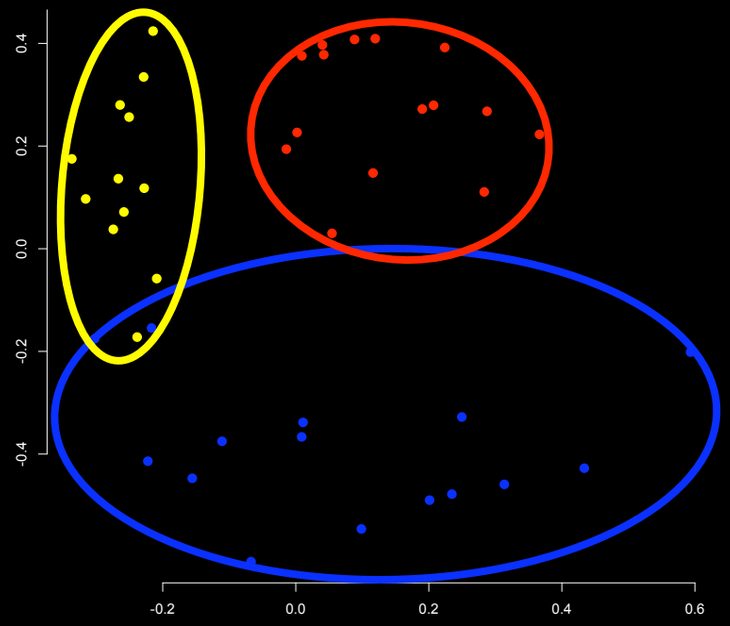
PerMANOVA:
month*stand P < 0.001 ***

Month

June

August

October



2005 (1 year)

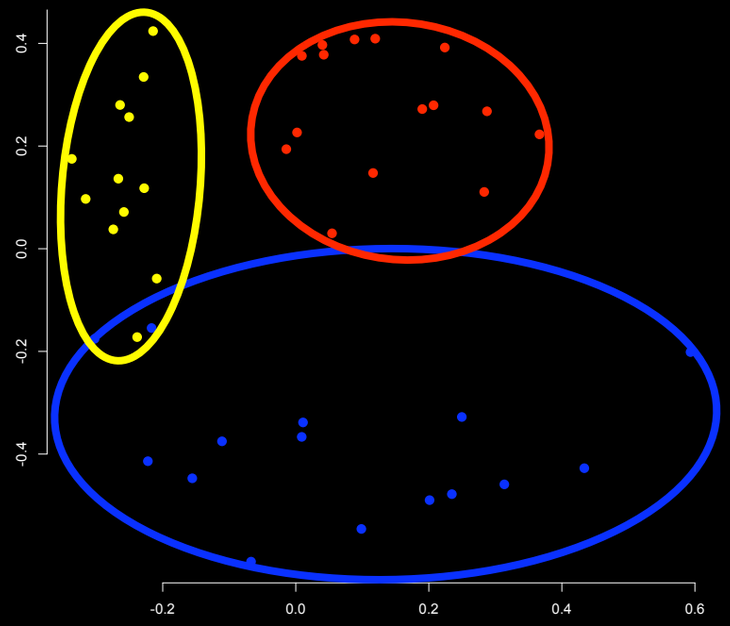
PerMANOVA:
month*stand P < 0.001 ***

Month

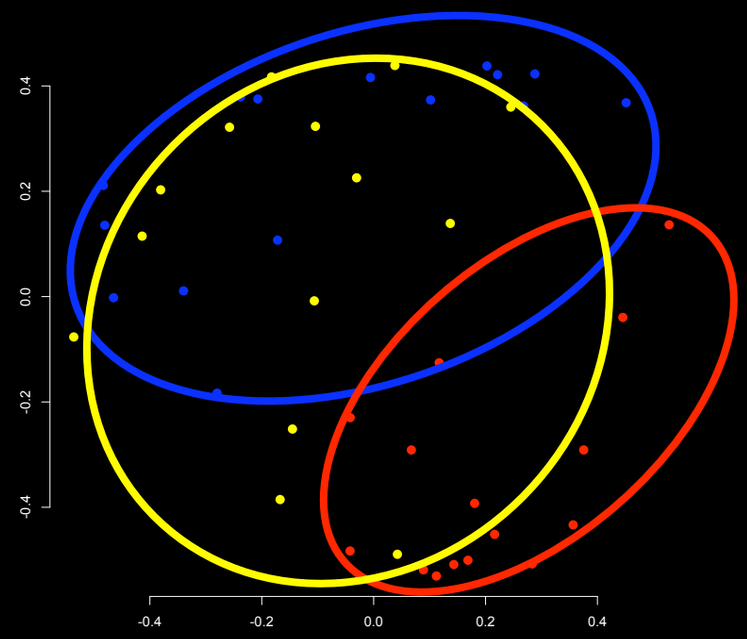
June

August

October



2005 (1 year)



2002 (4 years)

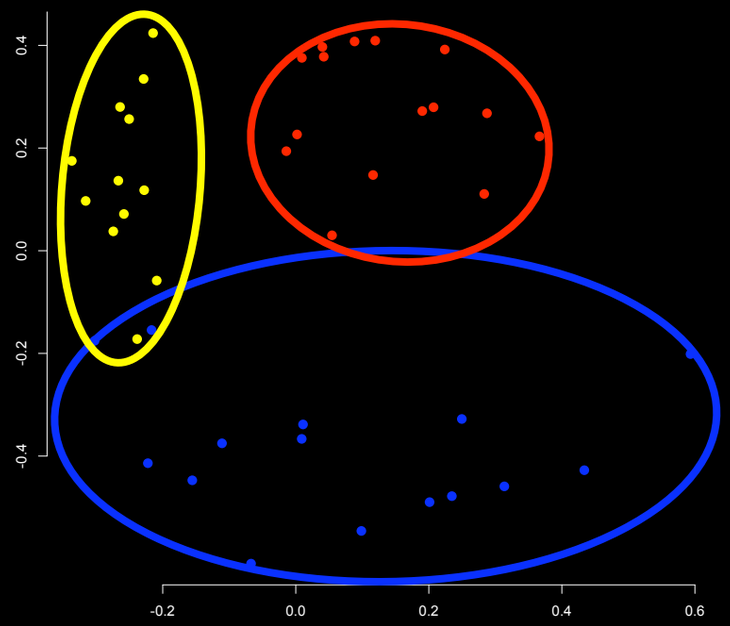
PerMANOVA:
month*stand P < 0.001 ***

Month

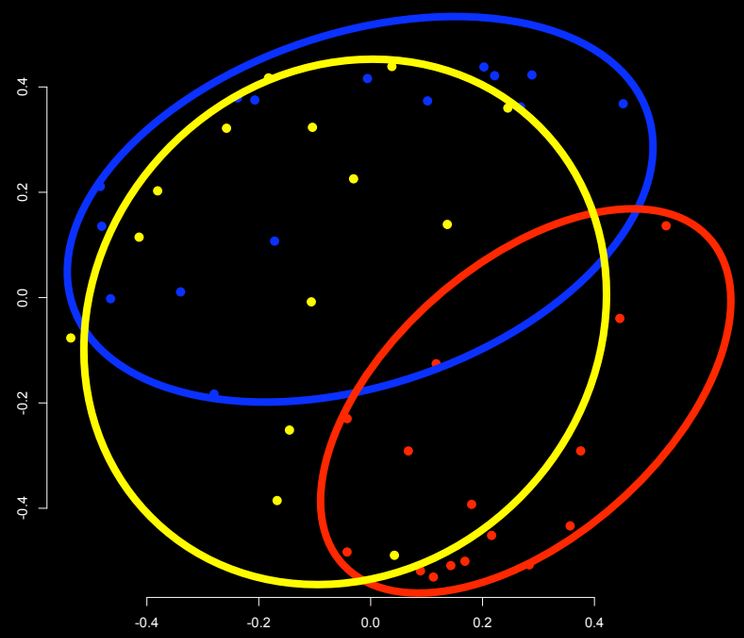
June

August

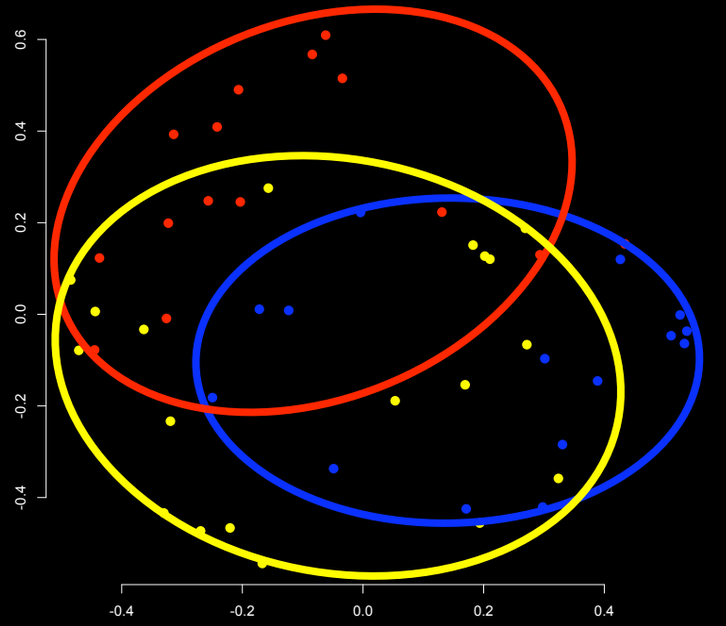
October



2005 (1 year)



2002 (4 years)



2000 (6 years)

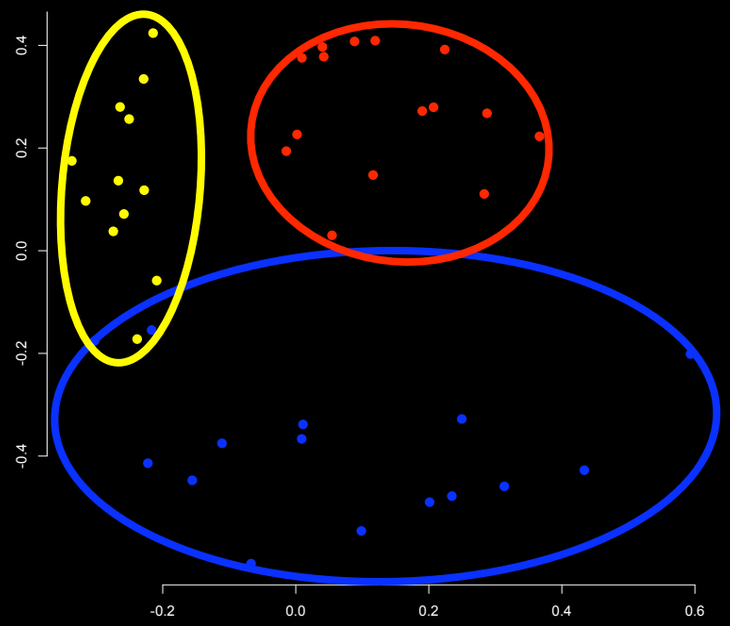
PerMANOVA:
month*stand P < 0.001 ***

Month

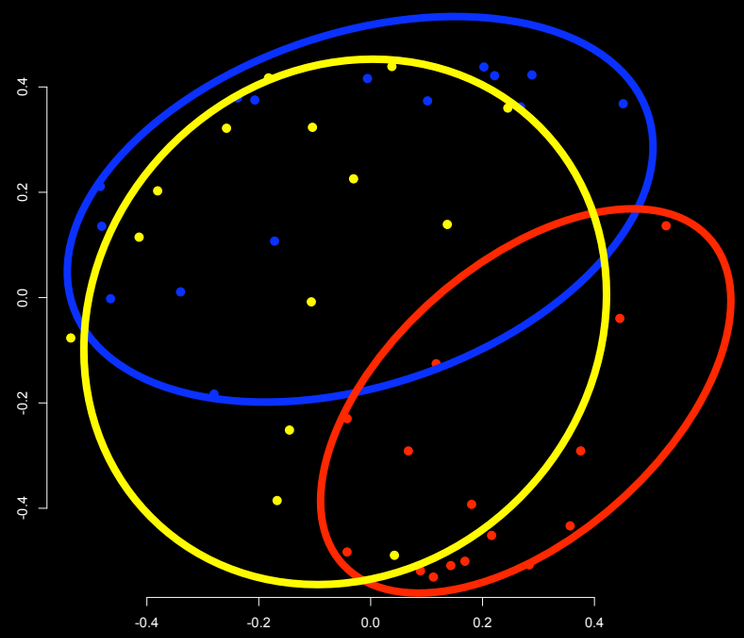
June

August

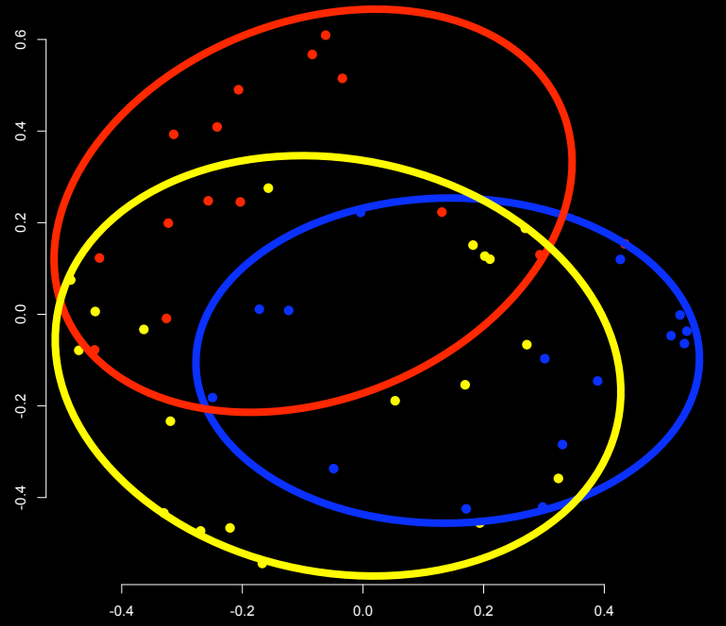
October



2005 (1 year)



2002 (4 years)



2000 (6 years)

Stand Age

PerMANOVA:
month*stand P < 0.001 ***

Conclusions

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- Local interactions can play a role in producing local community structure

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- Forces vary by month and by stand

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- Local interactions can play a role in producing local community structure
- Forces vary by month and by stand
  - Could result from stand-environmental or compositional differences

Take Home

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- Understanding local processes is important

Take Home

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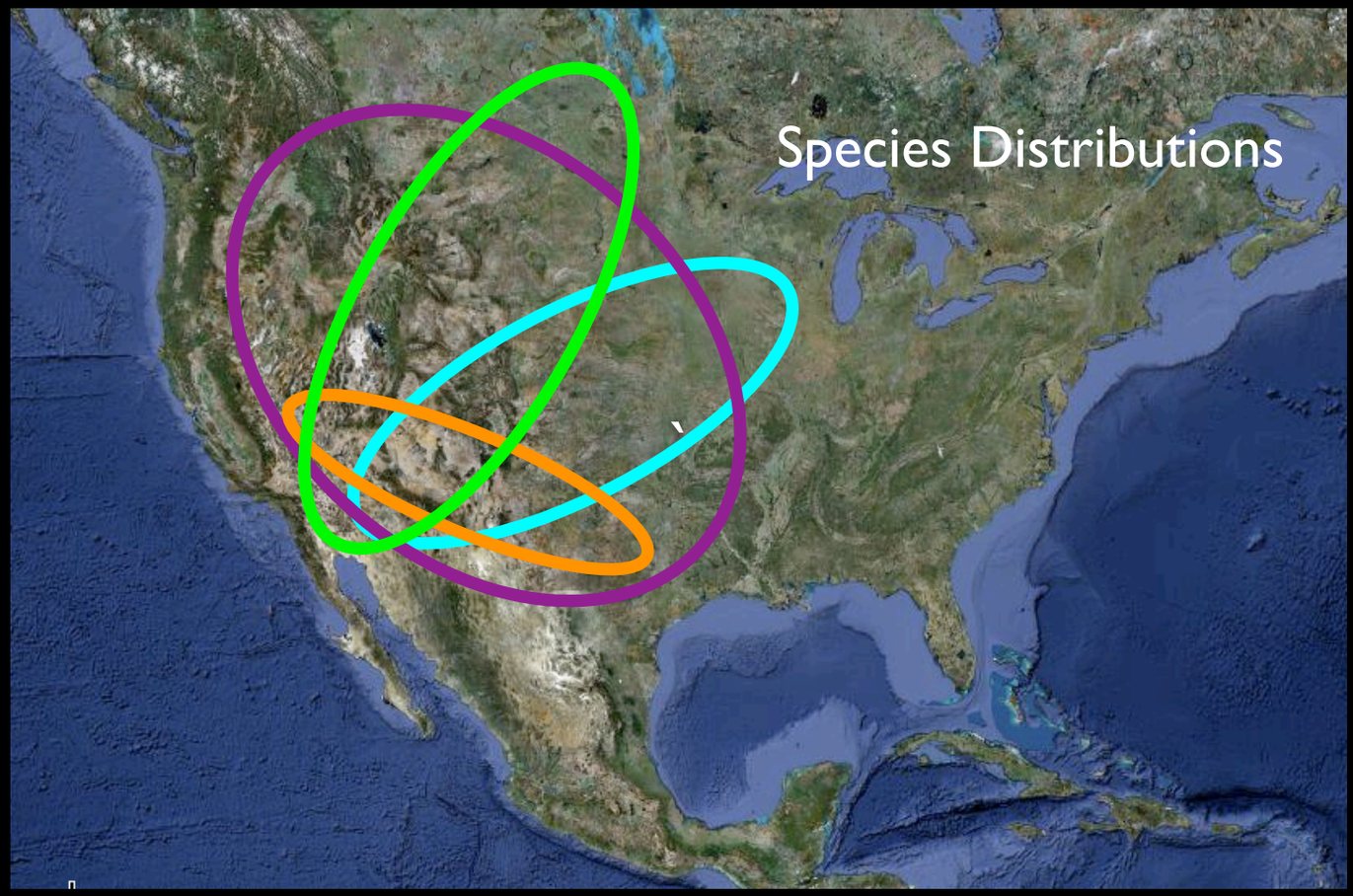
- Regional process are also important

Take Home

- Understanding local processes is important
- Regional process are also important
- Focus on the interplay of ecological and evolutionary process across spatial and temporal scales

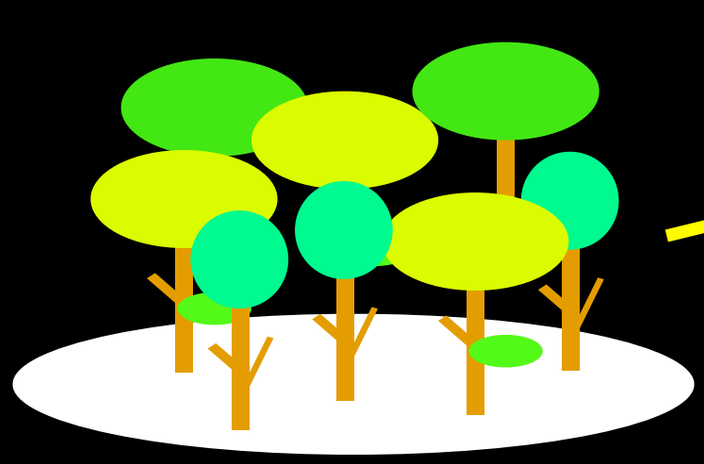
Take Home

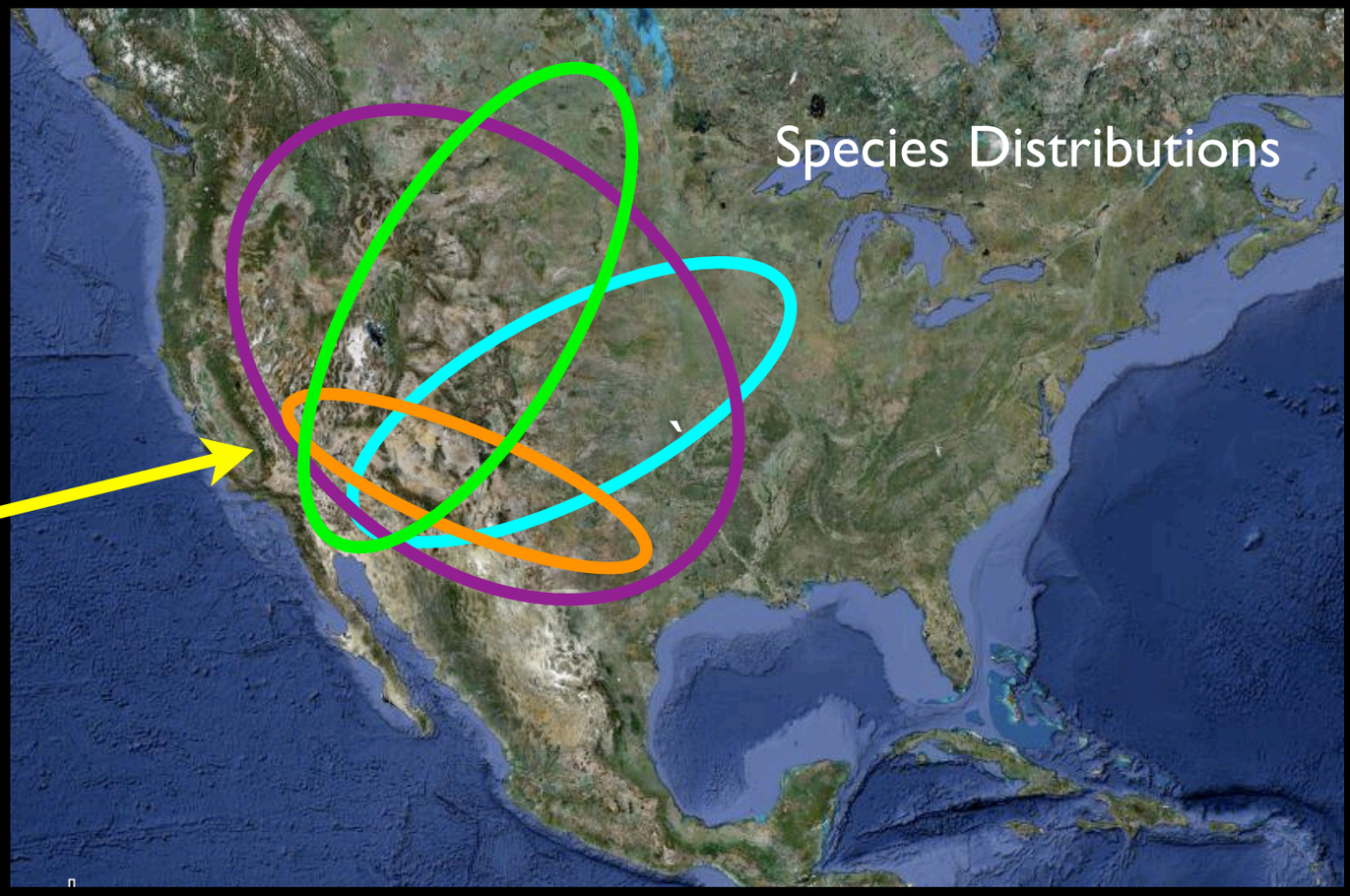
Local Scale



Larger Scales

Take Home

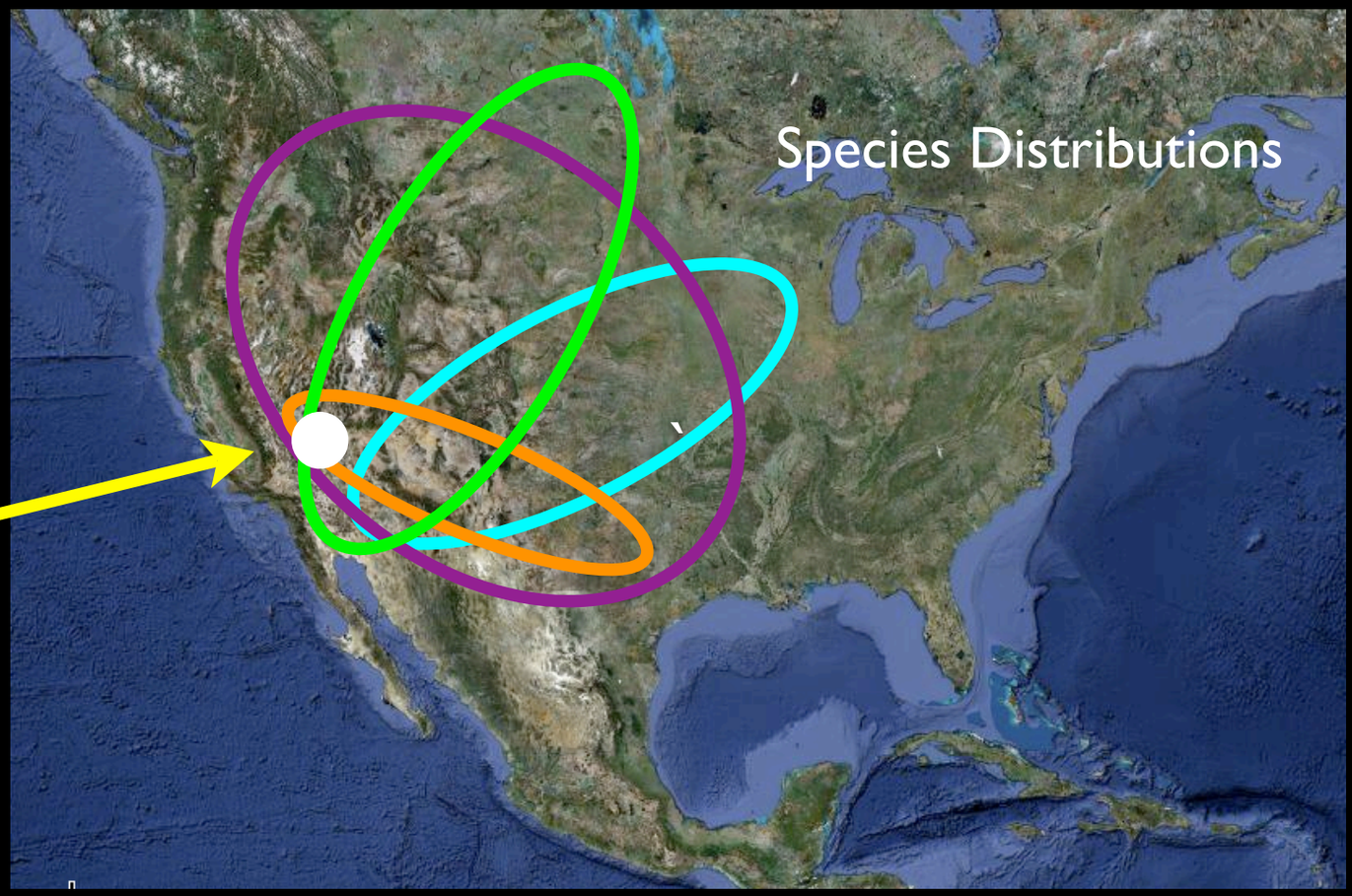




Local Scale

Larger Scales

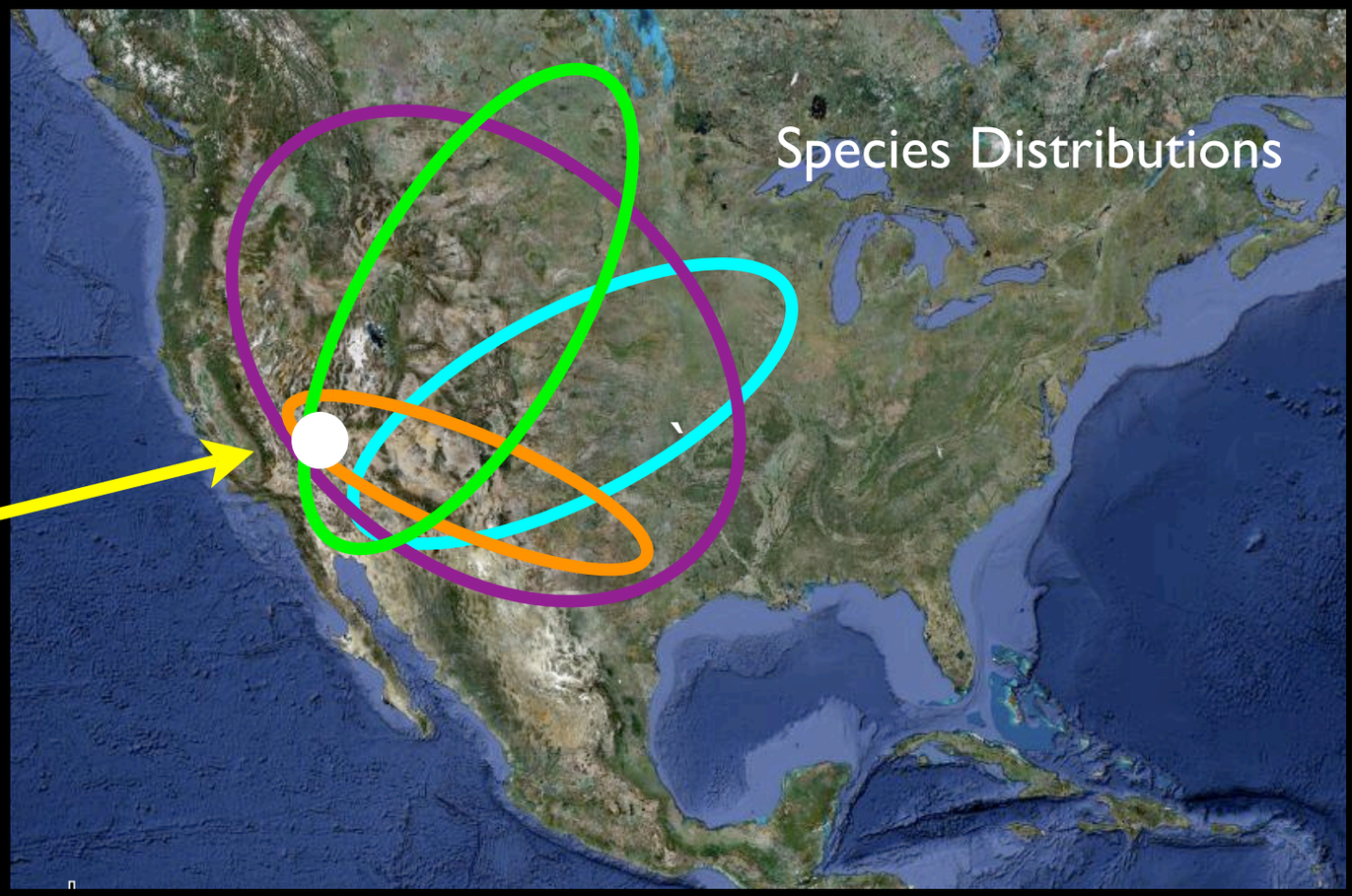
Take Home



Local Scale

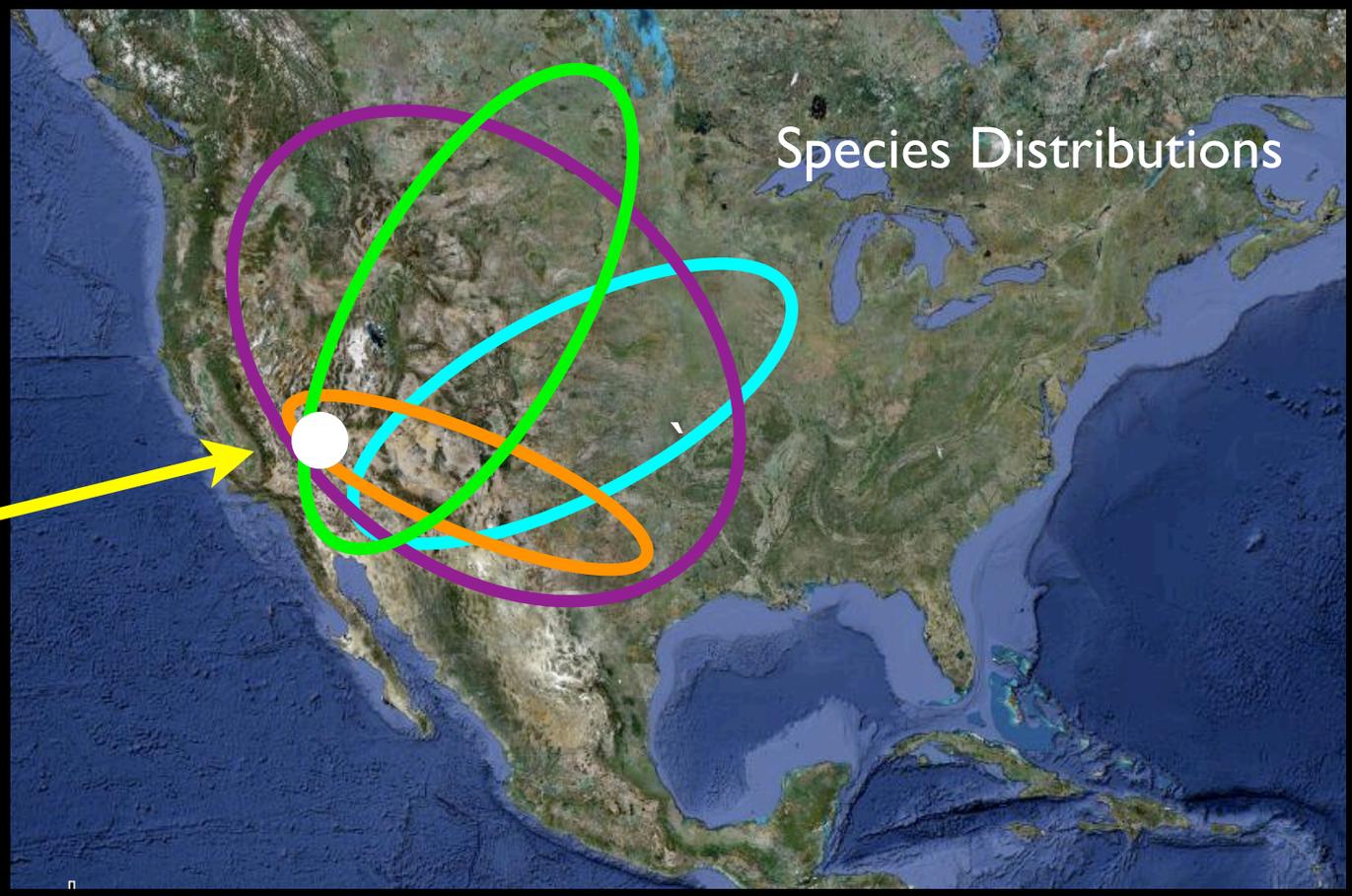
Larger Scales

Take Home



Local Scale → Larger Scales

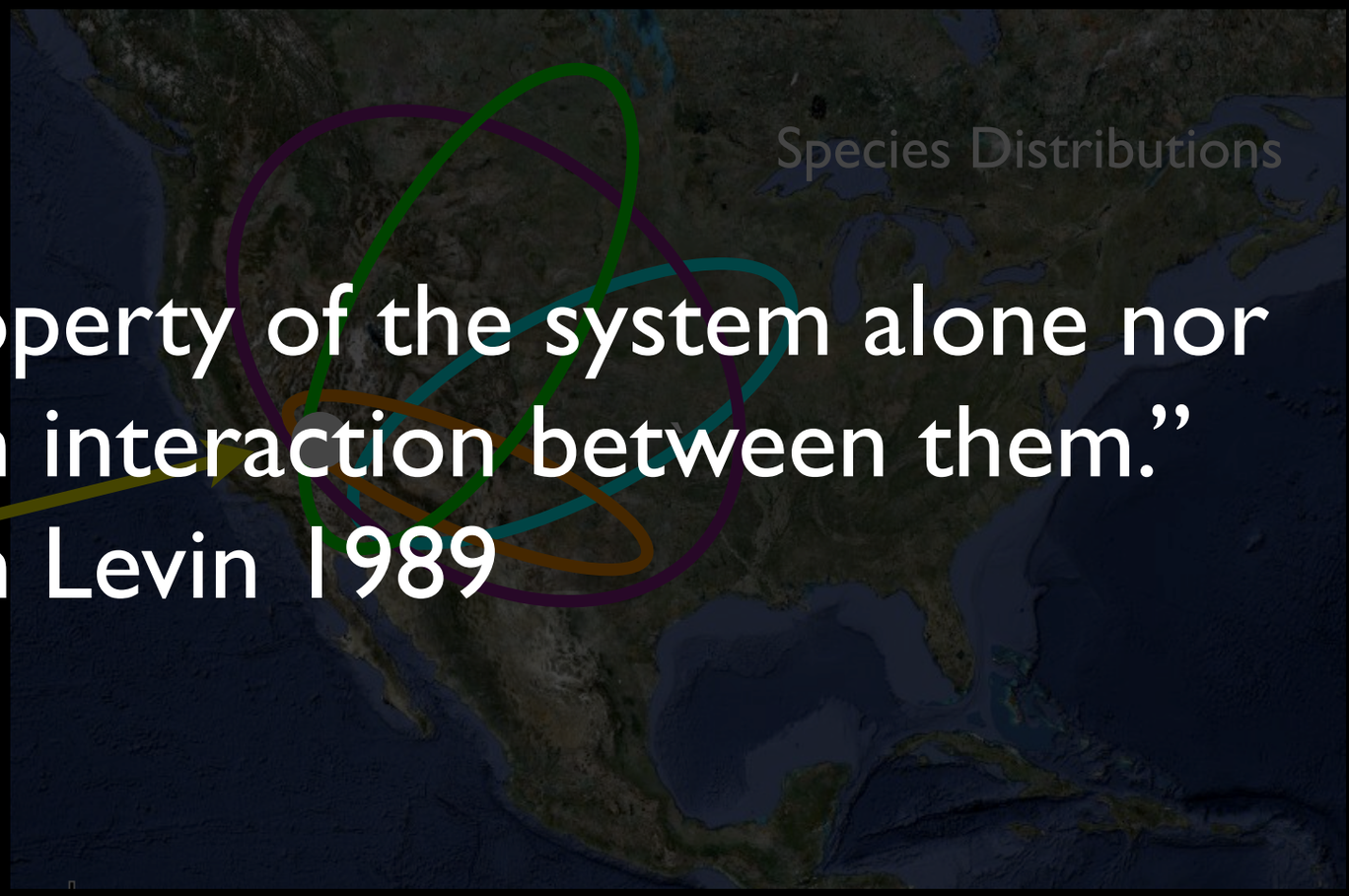
Take Home



Local Scale

Larger Scales

Take Home



"Pattern is neither a property of the system alone nor of the observer, but an interaction between them."

Simon Levin 1989

Local Scale ⇄ Larger Scales

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Todd Wojtowicz*

Jamie Lamit

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EcoSim (Aquired Intelligence and Kesey-Bear, Inc.)

statistical computing language

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