THE RUSTY BLACKBIRD BLITZ: PREDICTING THE ENVIRONMENTAL NICHE OF WINTERING & MIGRATING RUSTY BLACKBIRDS

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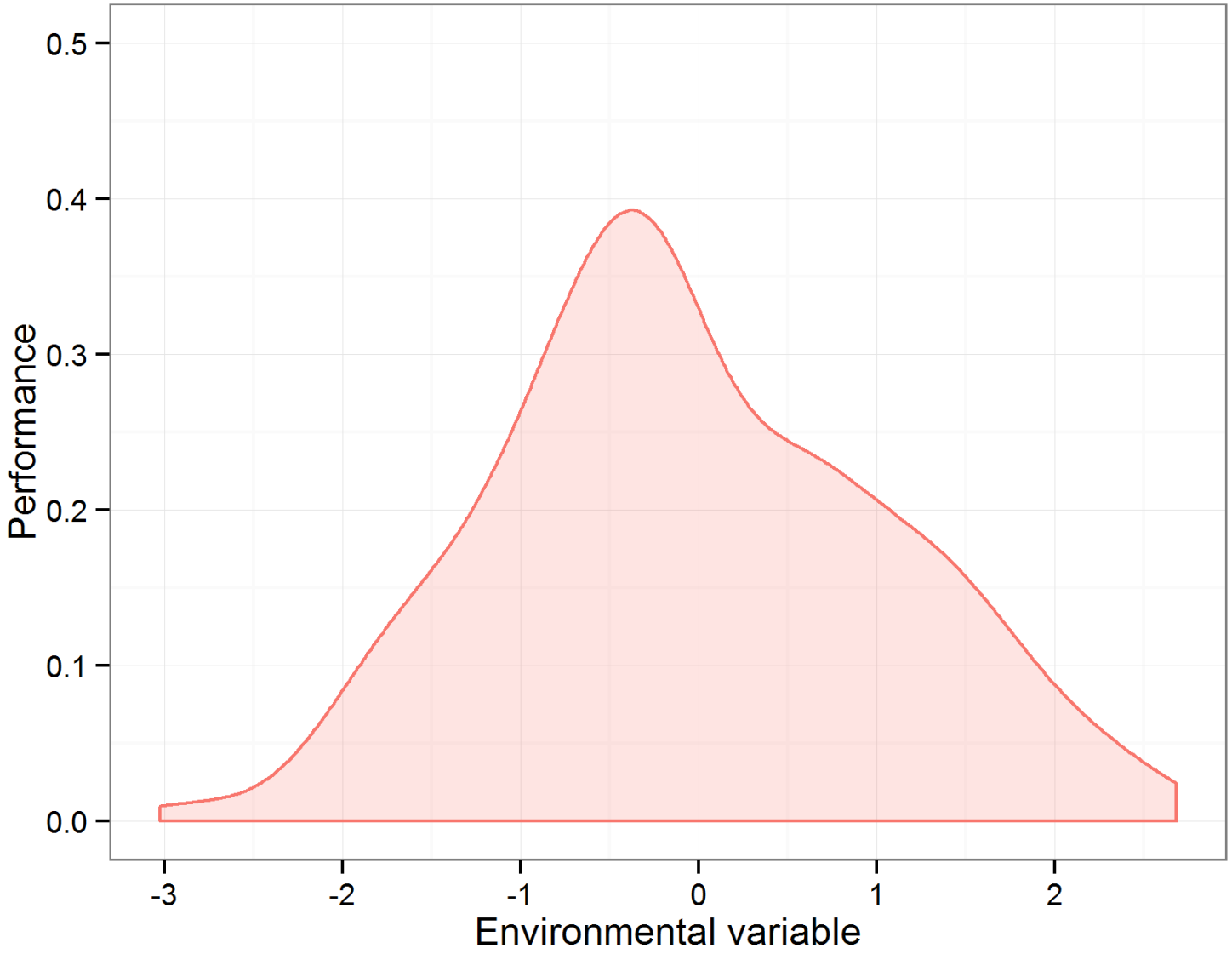
Sinead Borchert
Russ Greenberg

Photography: Paul Higgins

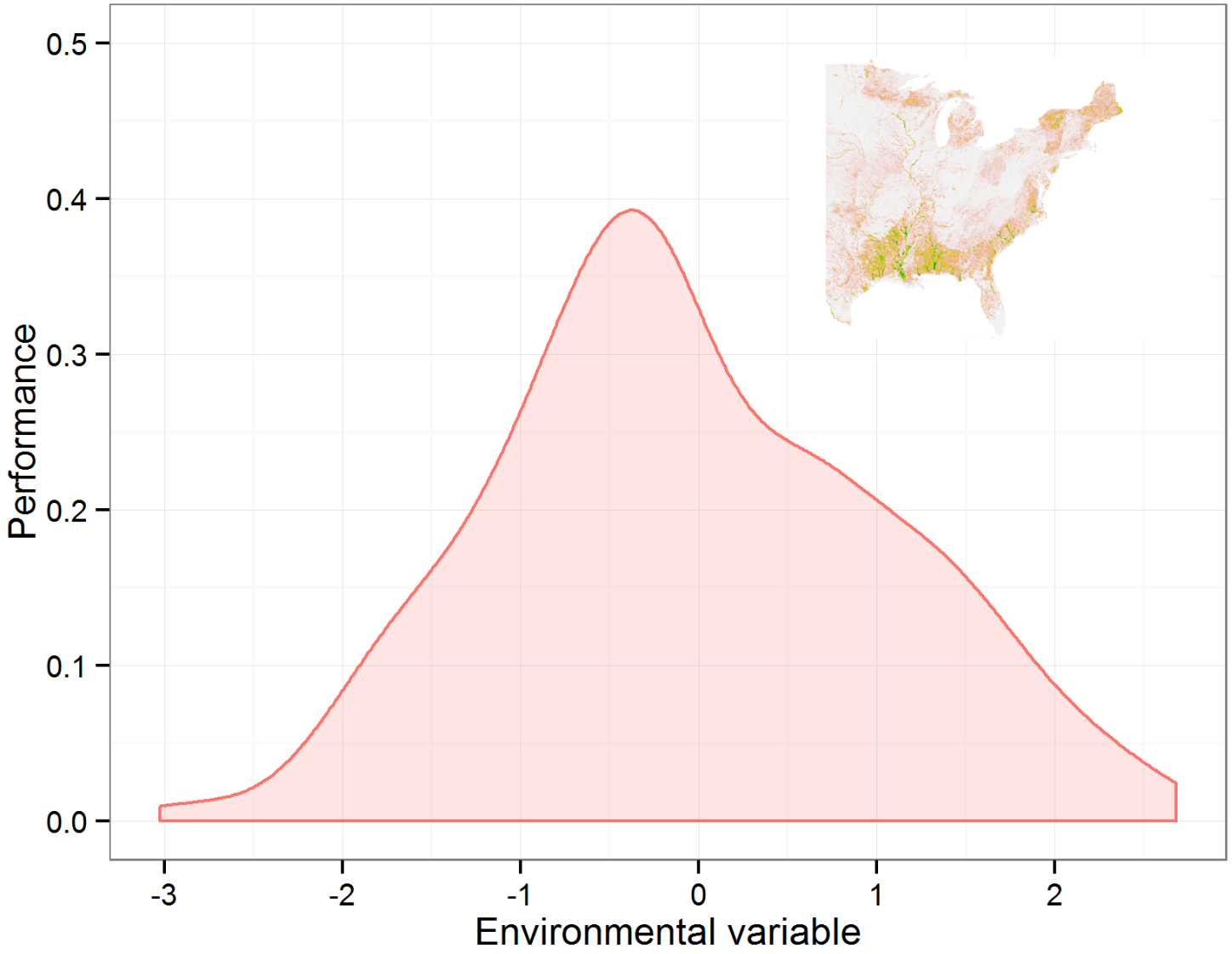
Overview

1) Goal: Predict hot spots for large flocks of Rusty Blackbirds
2) Habitat distribution modeling: The pros and cons of the MaxEnt approach
3) Methods (Model development)
4) Results

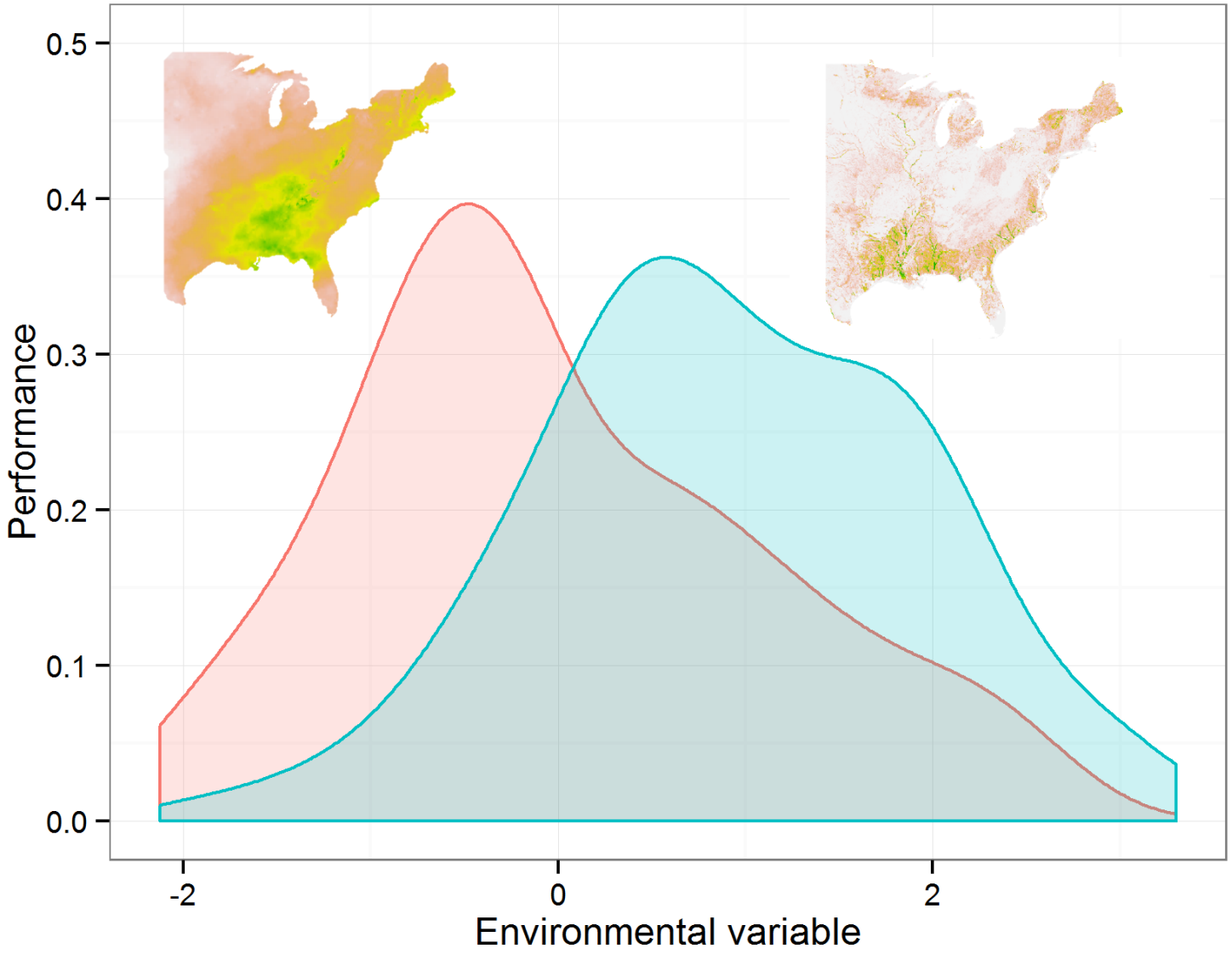
Thinking about niche …



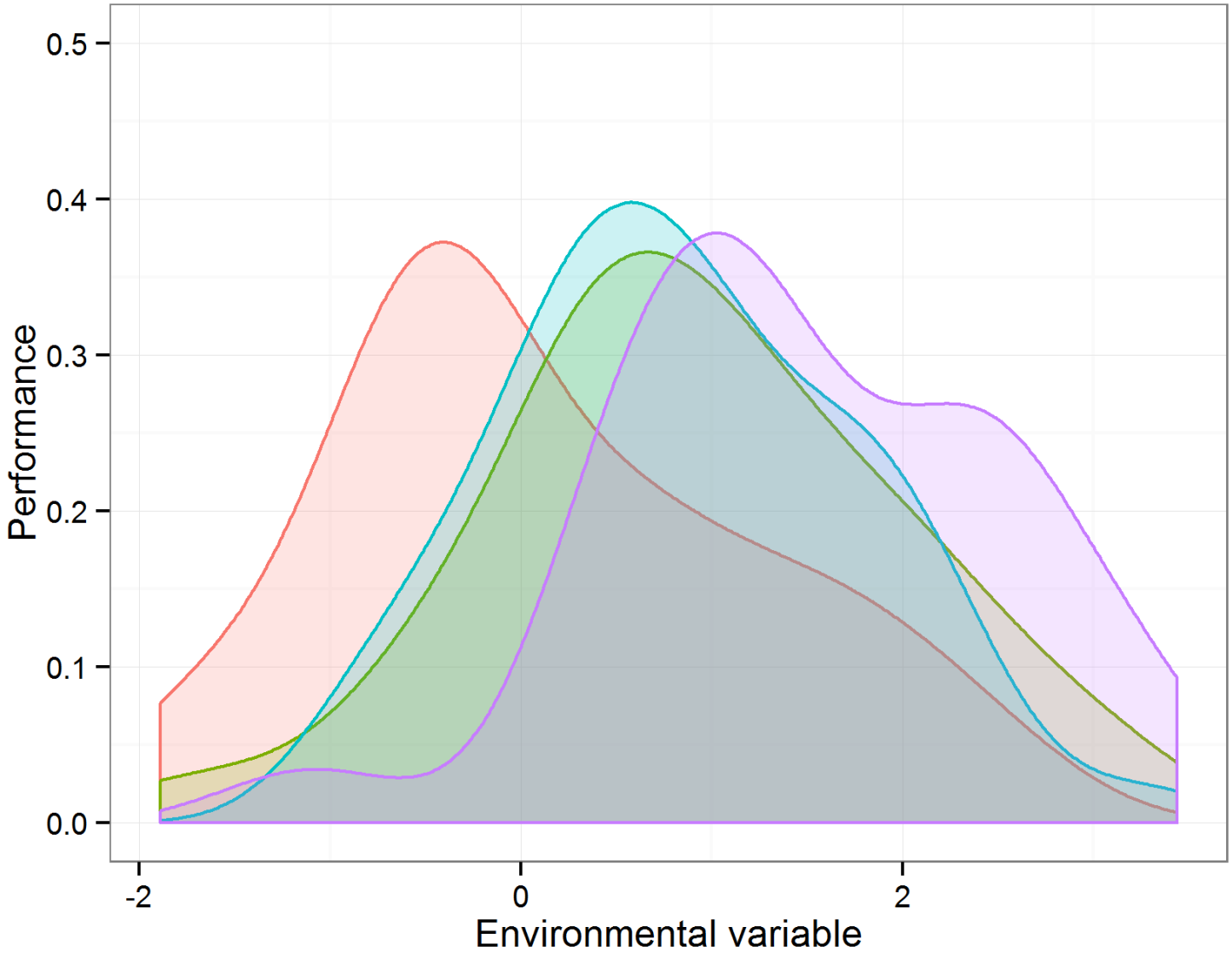
Thinking about niche …



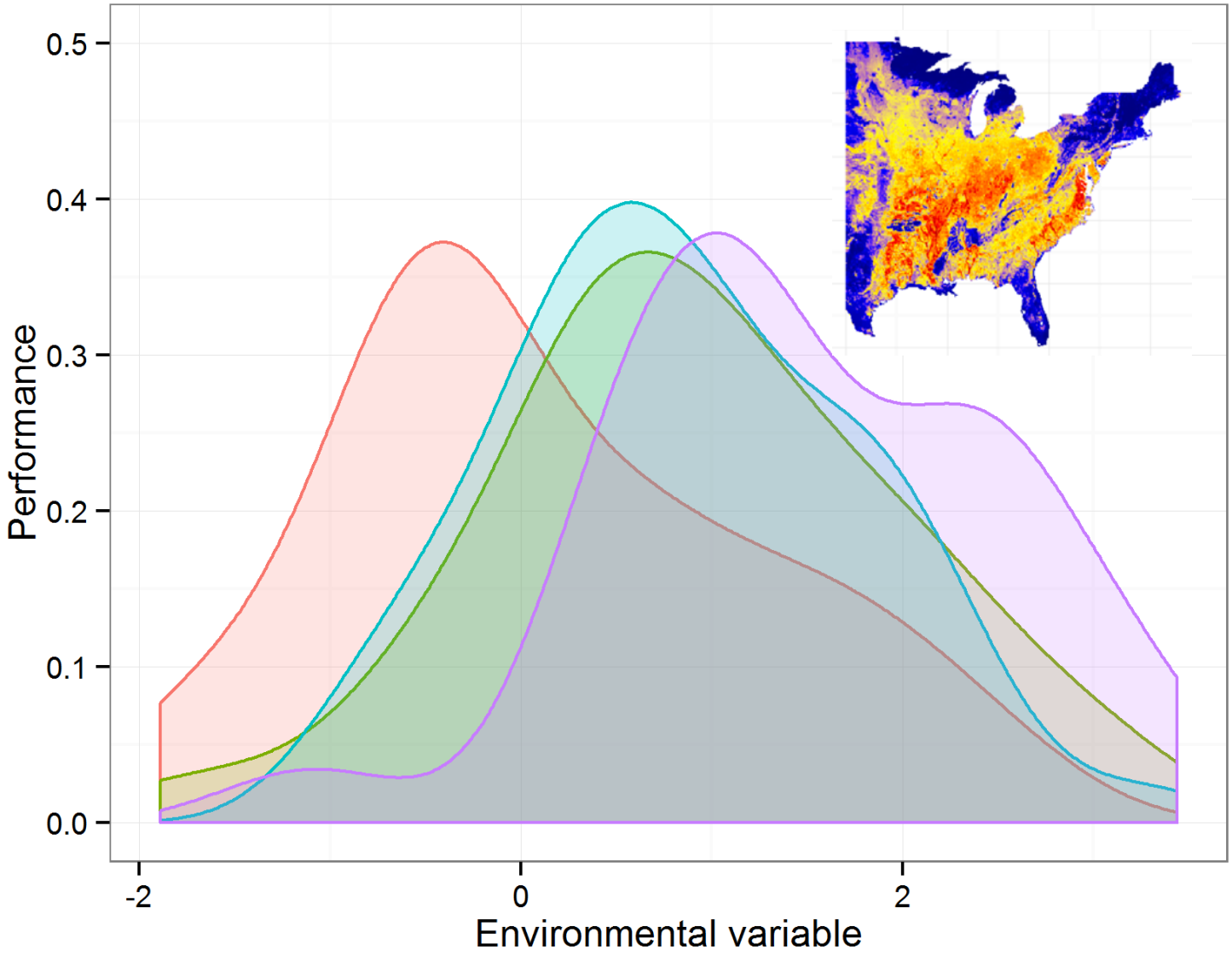
Thinking about niche …



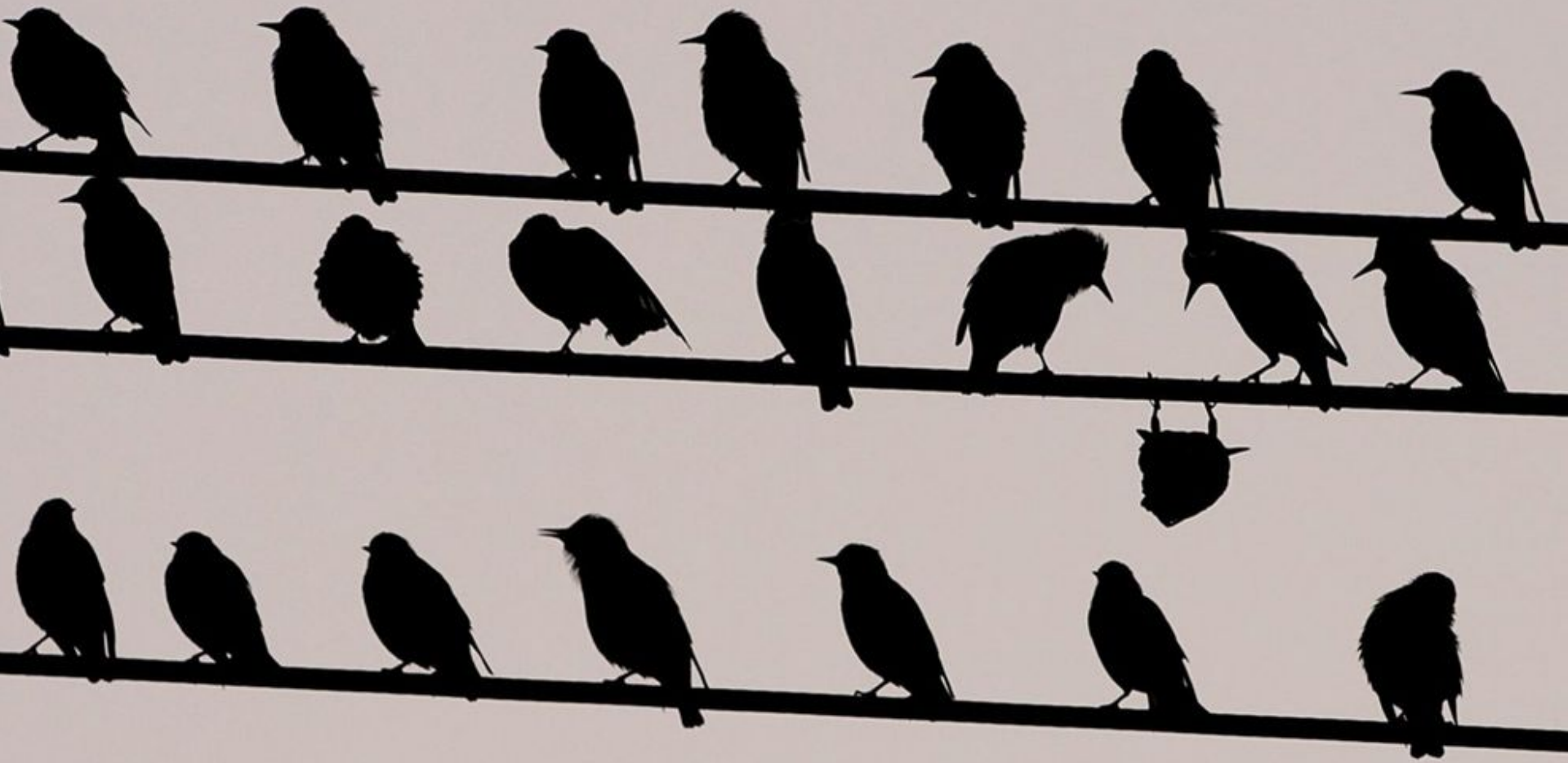
Thinking about niche …



Thinking about niche …



Using flocking behavior to inform niche



Using flocking behavior to inform niche

- Benefits of flocking
  - Anti-predatory behavior
  - Local enhancement
- The relationship between flock size and niche

Research questions

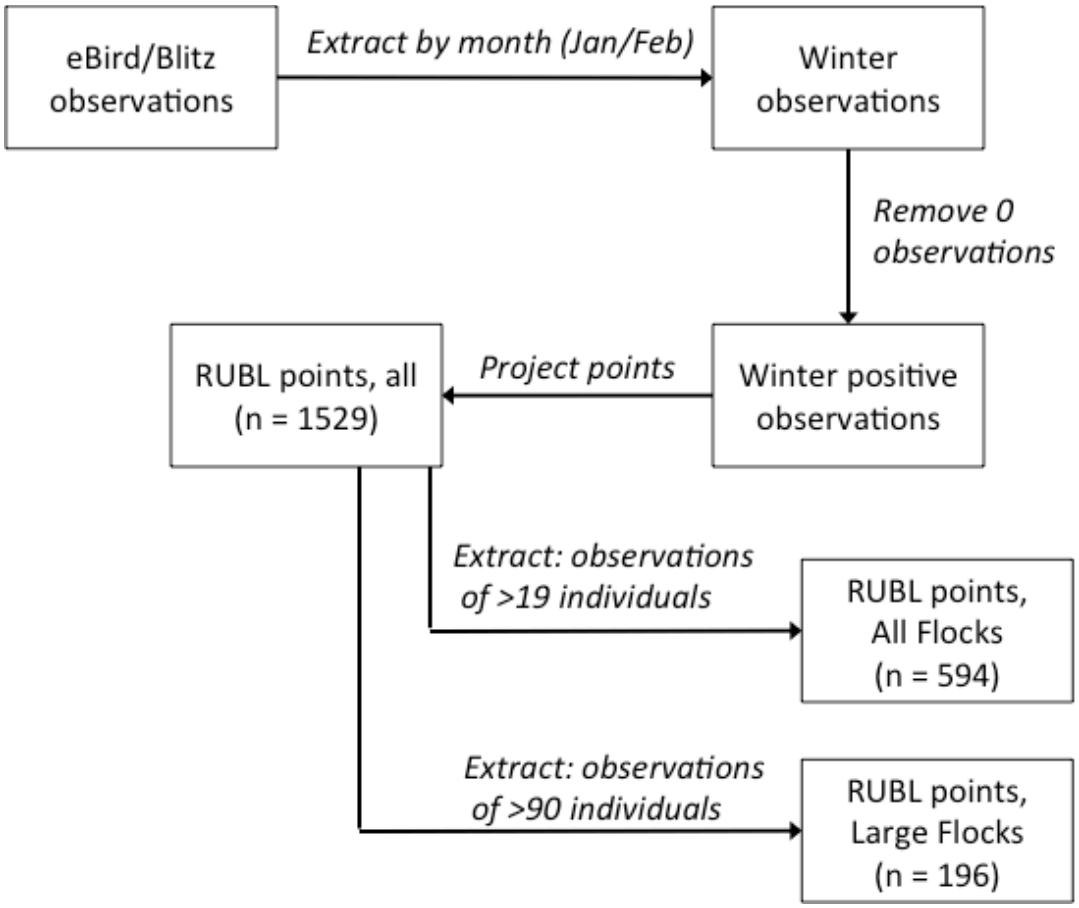
1) Does environmental niche width decrease with flock size?
2) Do different flock sizes represent different environmental niches?
3) Which environmental variables best predict the distribution of Rusty Blackbird flocks?

Methods: Distribution modeling overview

- **MaxEnt limitations**, models:
  - Describe distribution in realized niche space
  - Tend to be overfit
  - May be heavily influenced by sampling bias
  - Observations are spatially autocorrelated

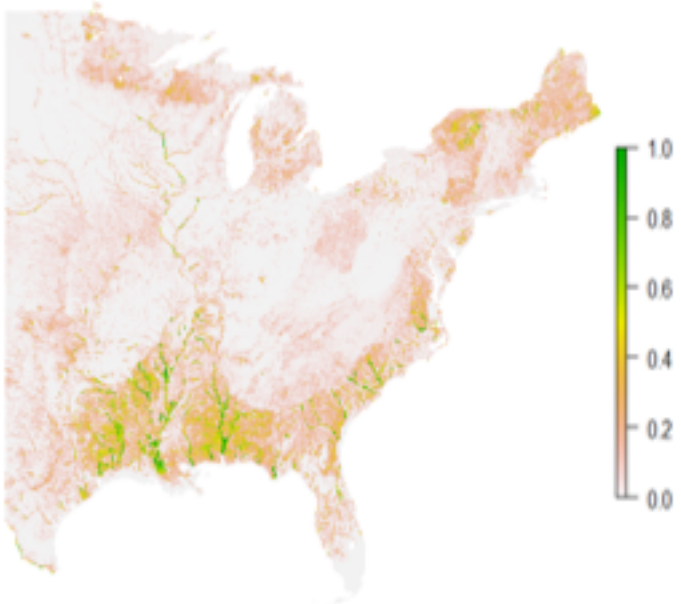
Model building: observational data

- Data collected from RUBL Blitz and eBird
- Summarize by date and flock size classes (Winter vs. Migration!)
- Extracted to 4 km resolution grid

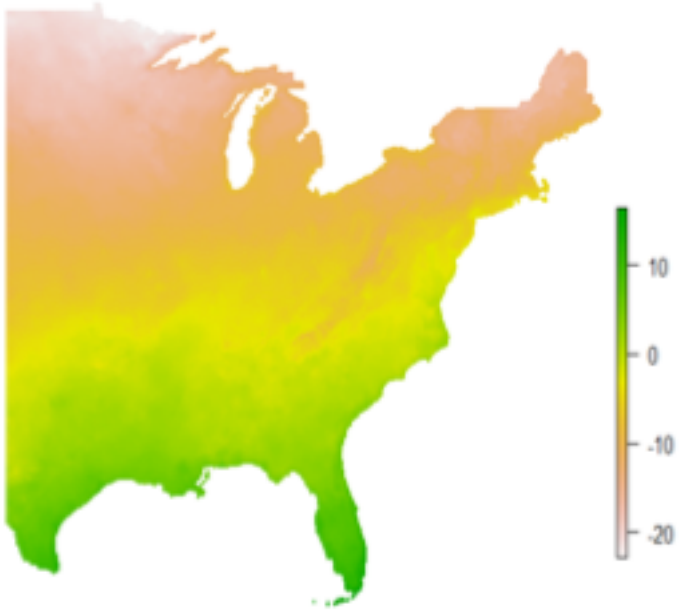


Model building: Environmental data

- Land cover: US GAP Analysis Project, 30 m resolution
  - Reclassified
  - Aggregated to 4 km resolution

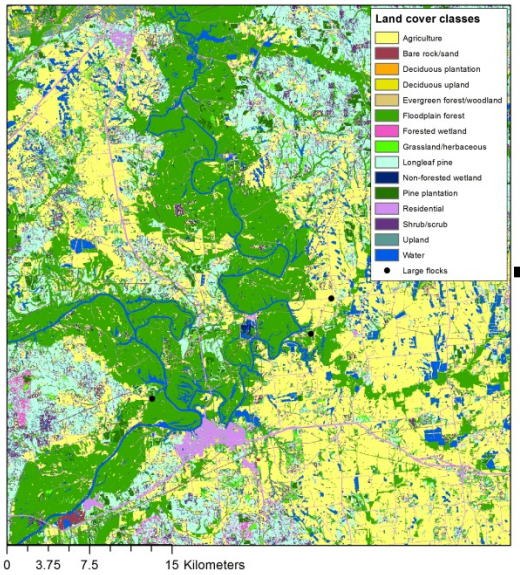


- Climate: precipitation (ppt) and minimum temperature (tmin): 4 km resolution
  - Winter: Mean across period
  - Spring: Mean within sampling periods

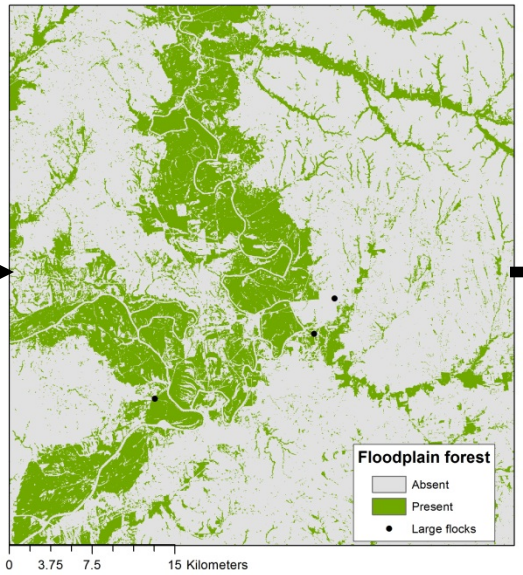


Model building/processing example: Black Belt Alabama

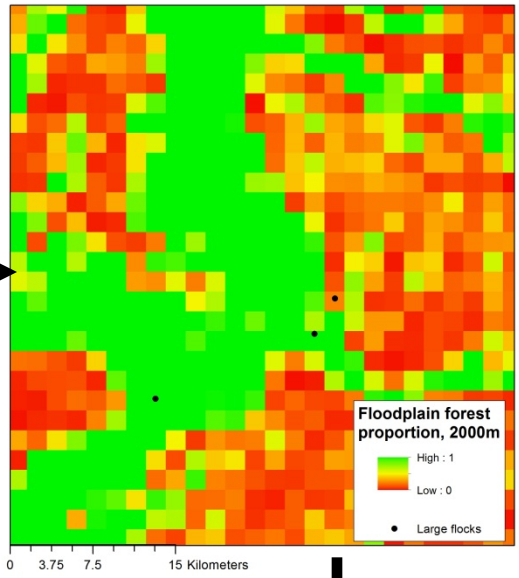
Reclassified land cover



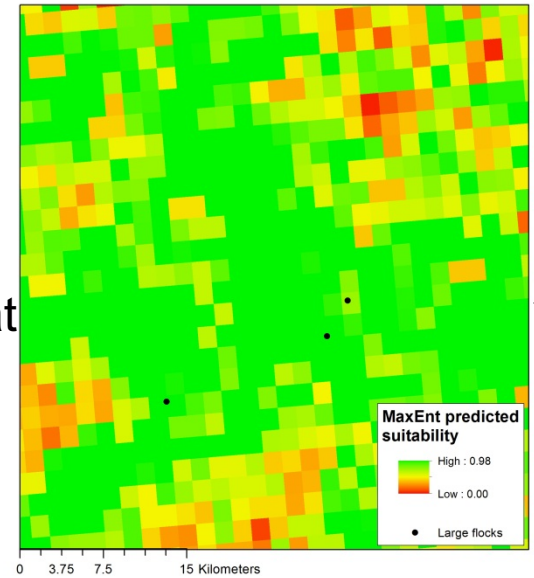
Binary land cover, floodplain



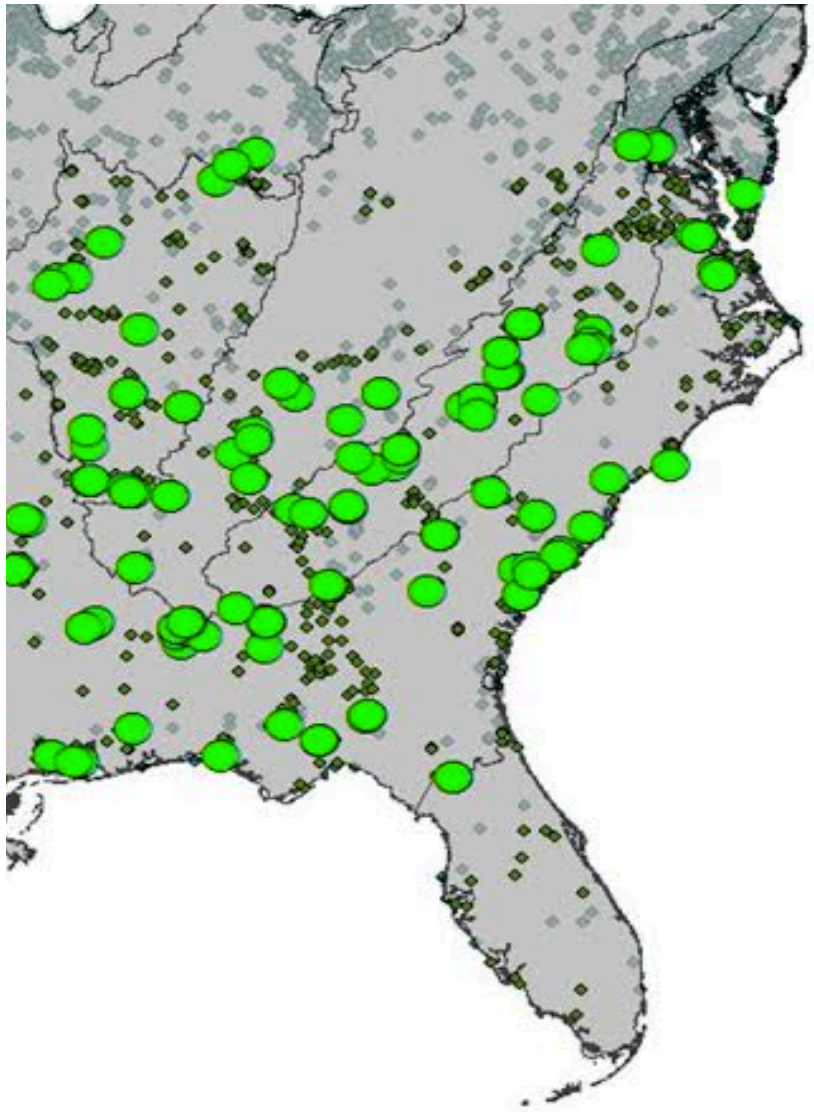
Proportional land cover



Maximum entropy model output: Probability of habitat suitability



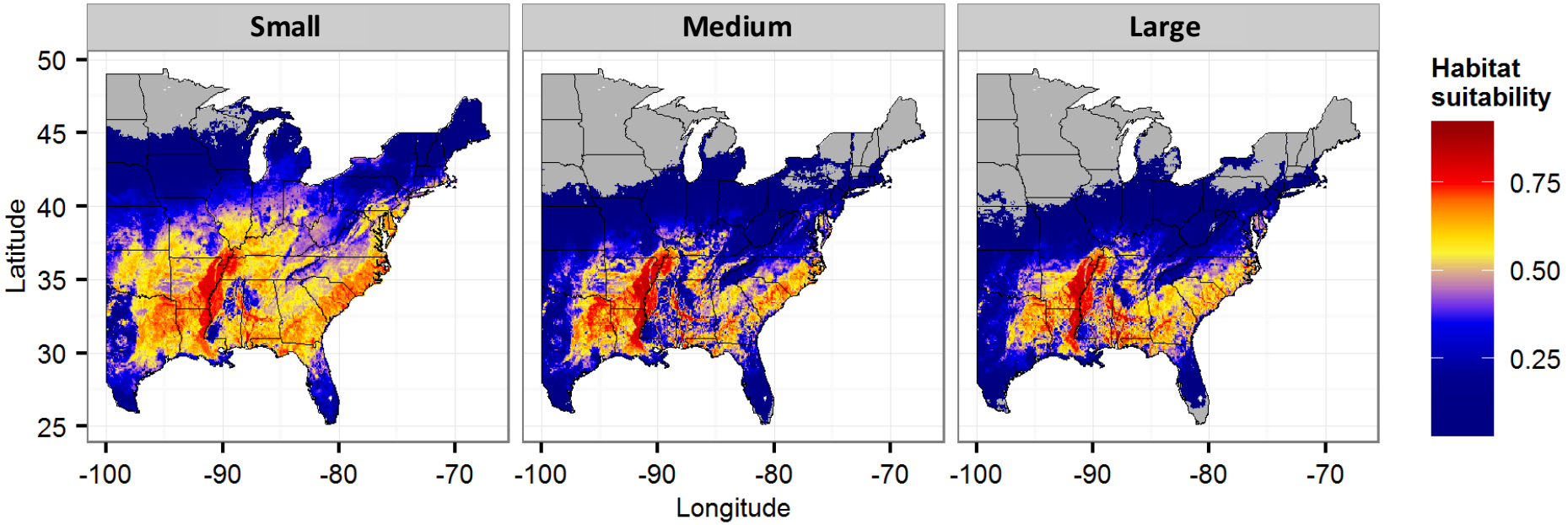
Model building



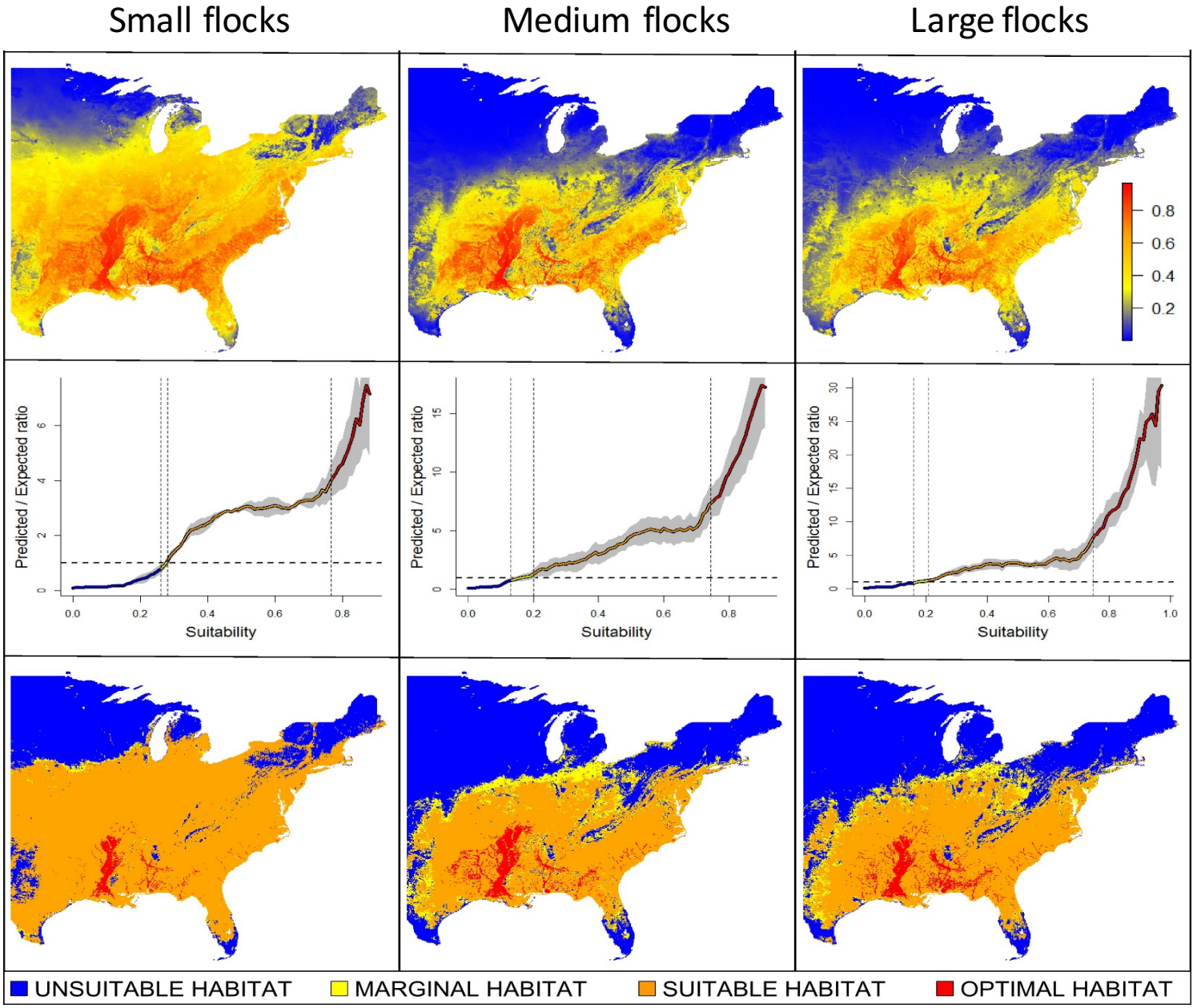
- Sampling bias:
  - **Background points** generated from non-RUBL observations with eBird during sampling periods.
- Model overfitting
  - Interactions and quadratic terms added individually prior to modeling
  - AIC used for selection of beta parameter

Results:
Winter Blitz

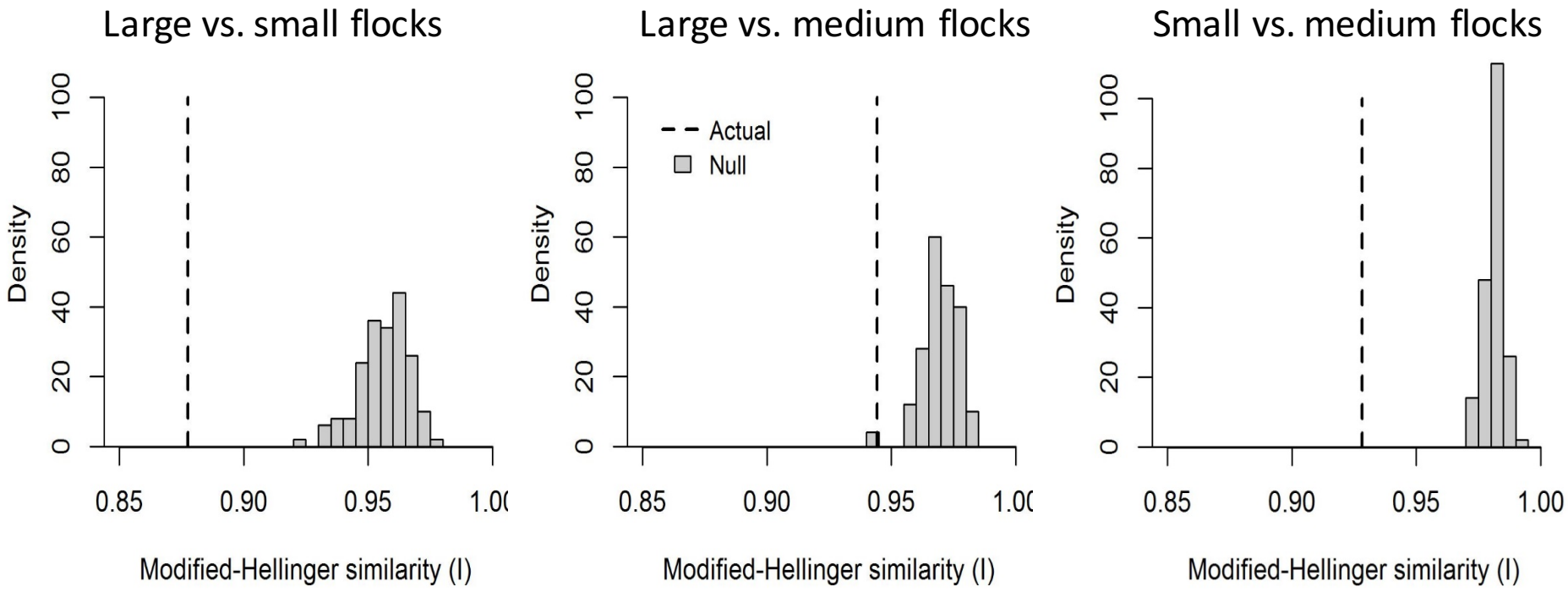
Probability maps: Winter



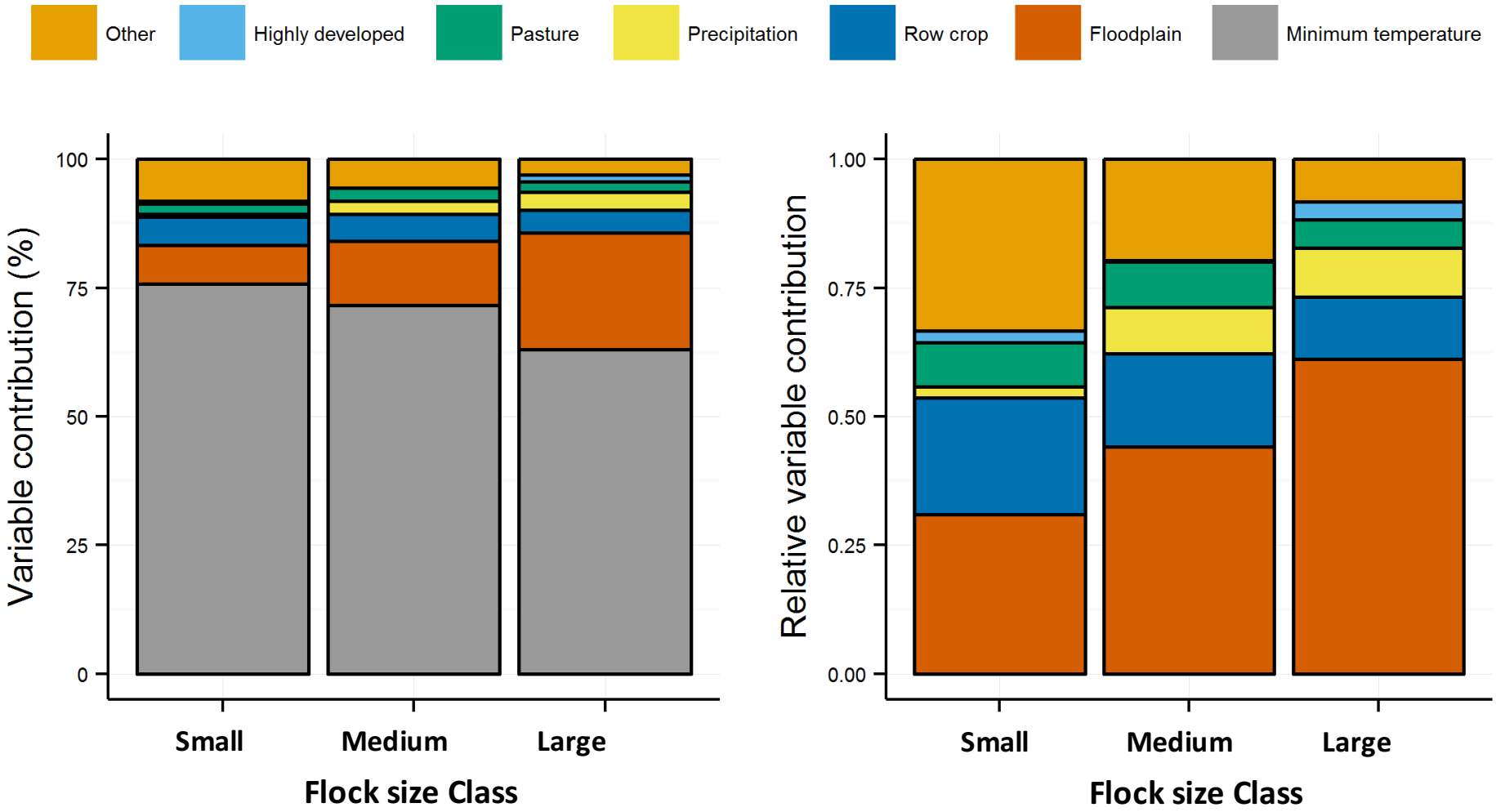
Does niche width vary by flock size?



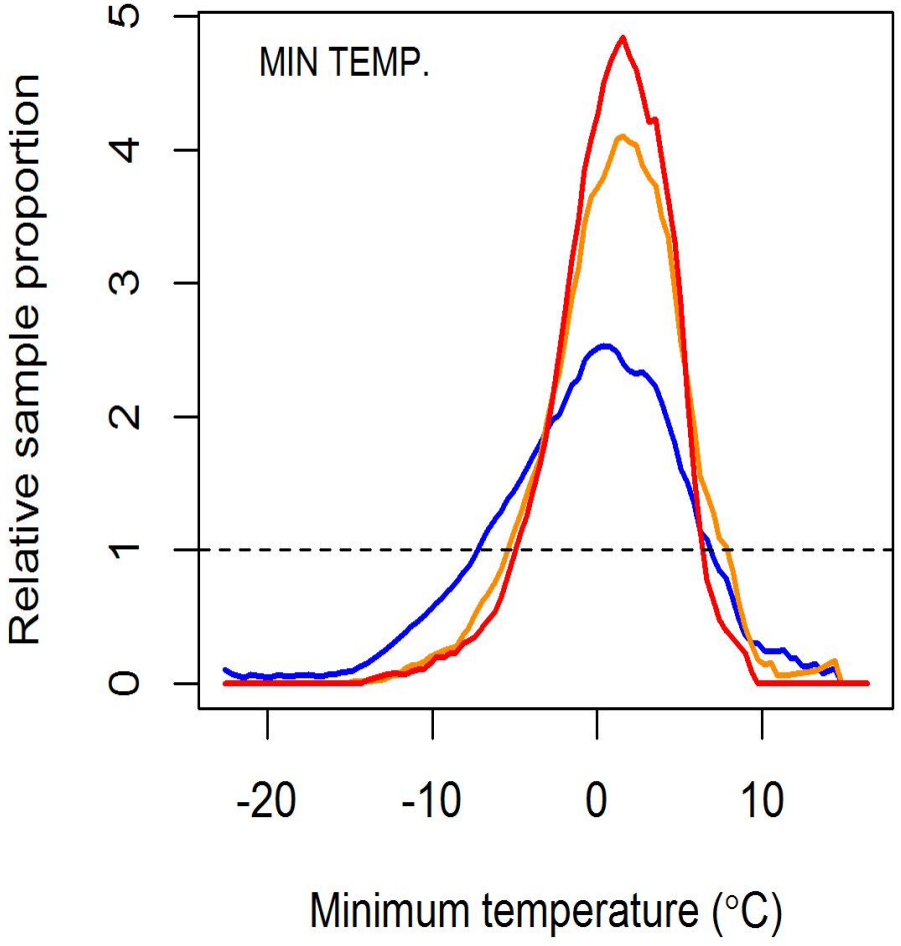
Do different flock sizes occupy different realized niche space?

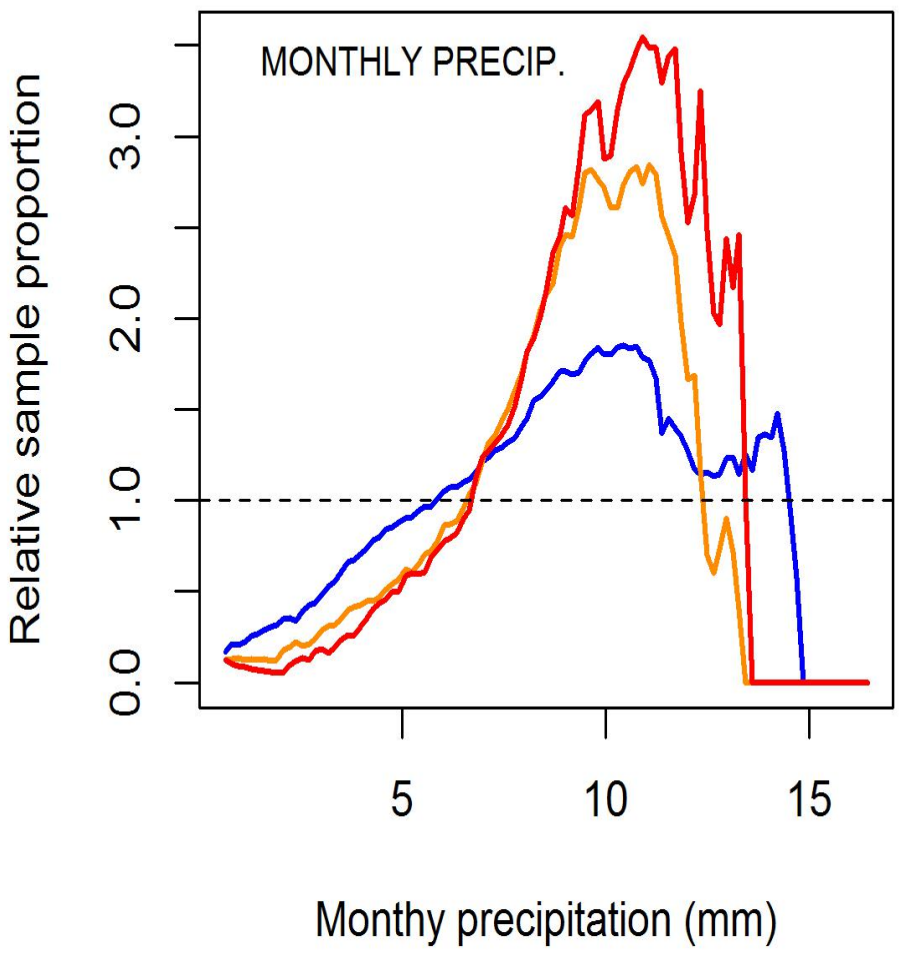


Variable contribution: Winter



Which environmental variables contribute the most to habitat suitability for small, medium, and large flock observations?





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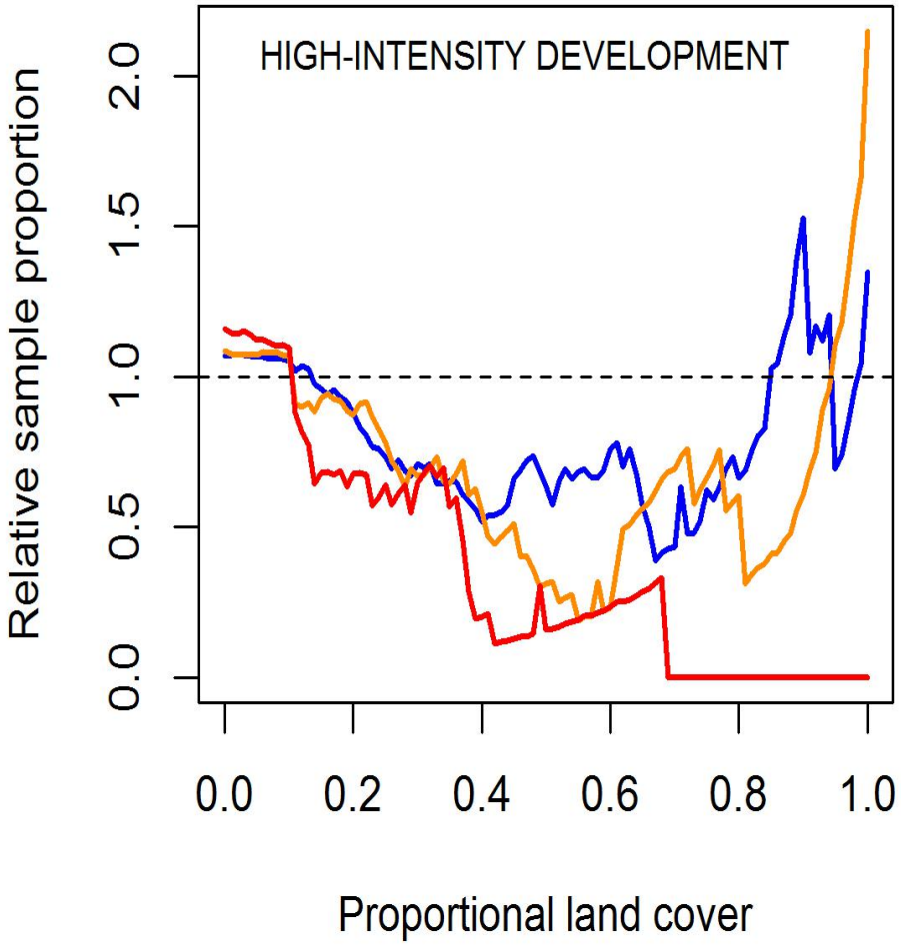
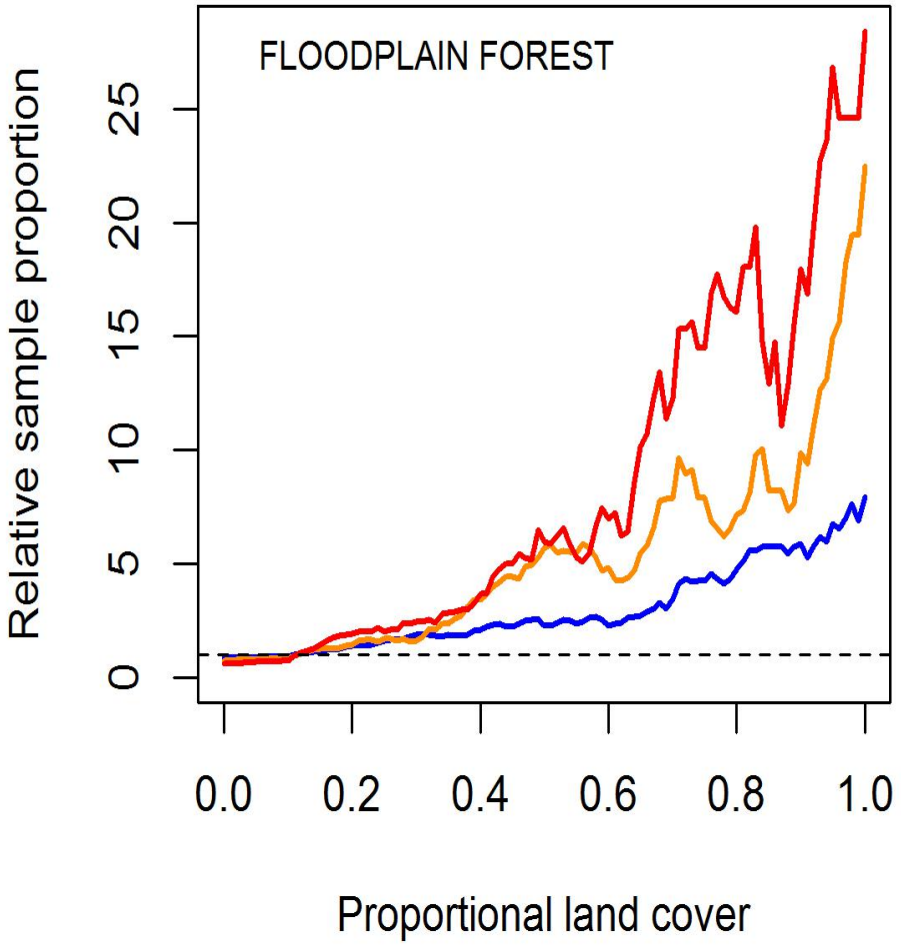




Conclusions: Winter

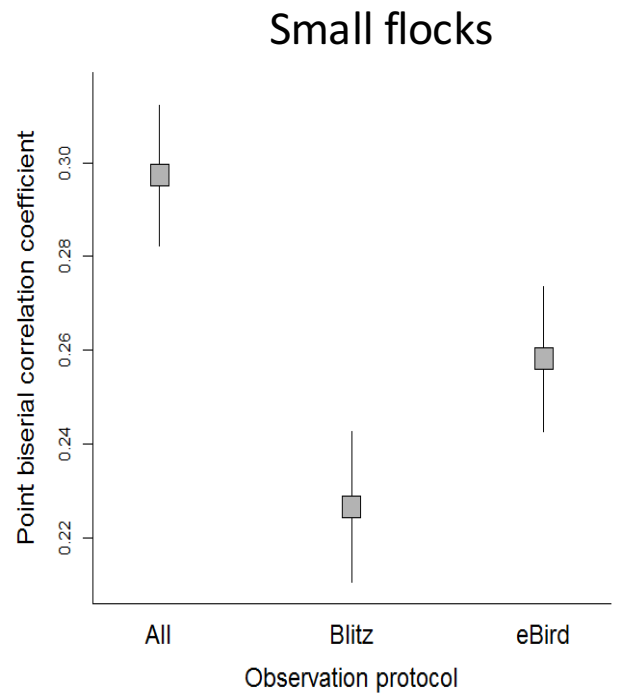
1. Environmental "niche width" decreases with increasing flock size but was similar for medium and large flocks.

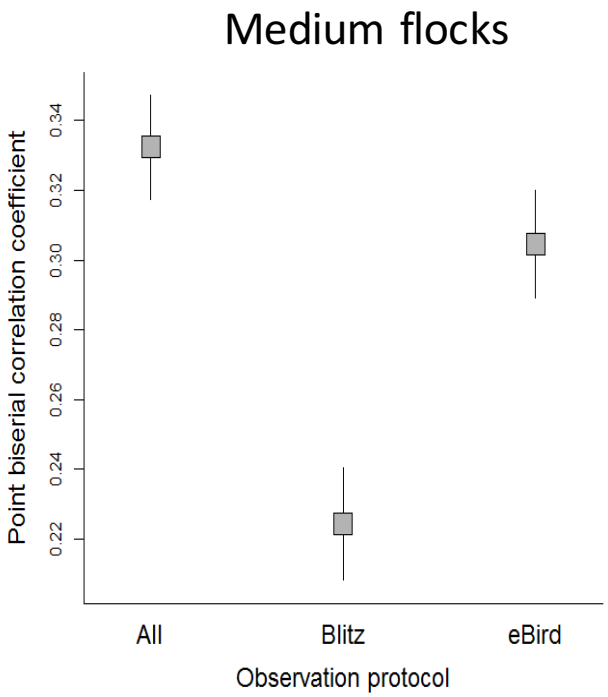
2. Realized ecological niches differed across flock size classes.

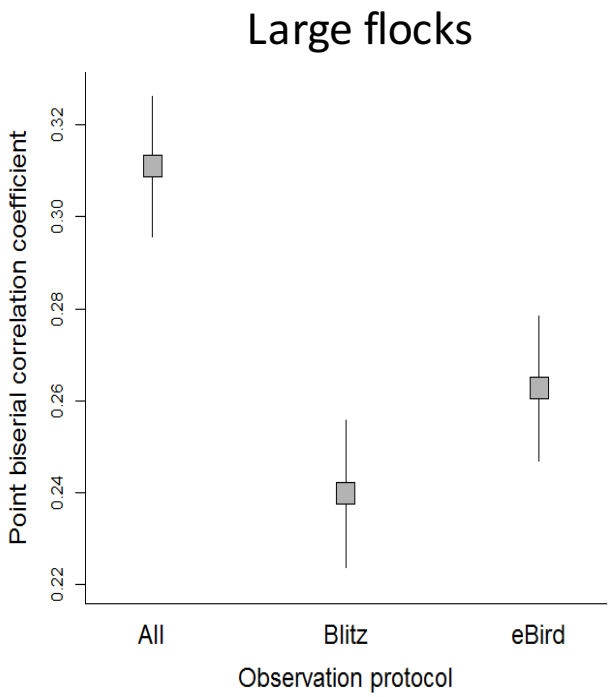
3. **Minimum temperature** and **floodplain forest** were most predictive of the RUBL distributions across flock size classes.

4. For large flock and individual sightings, Blitz data improved suitability estimates.

Aside: Did Blitz data improve suitability estimates?

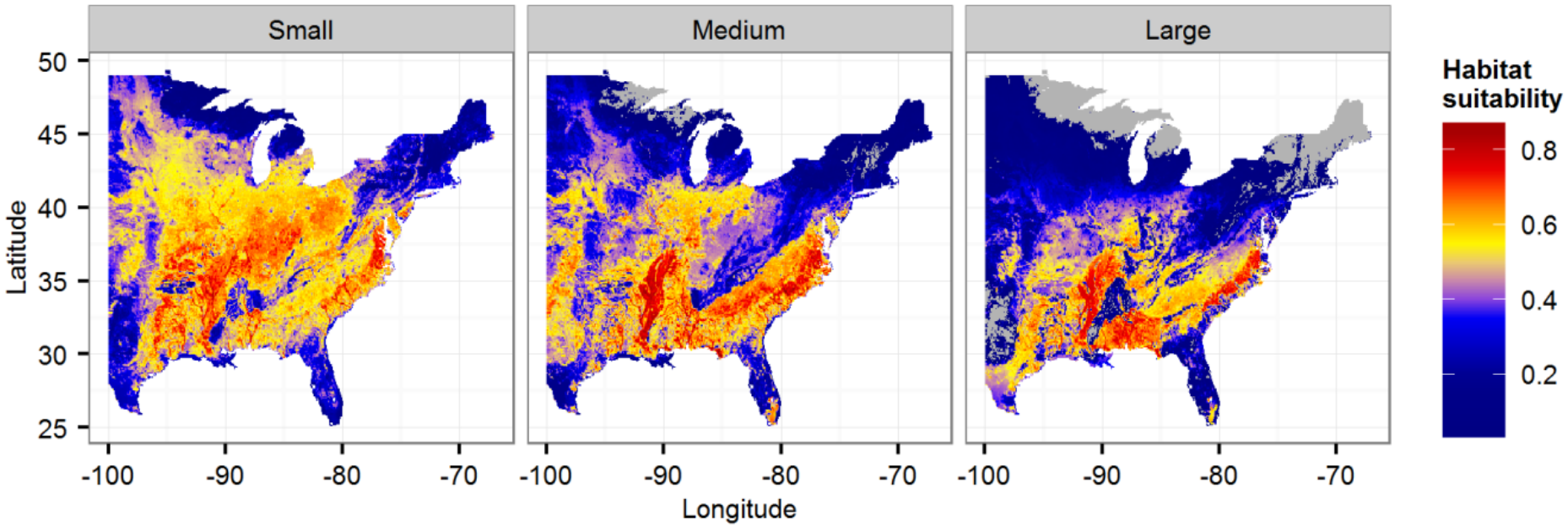




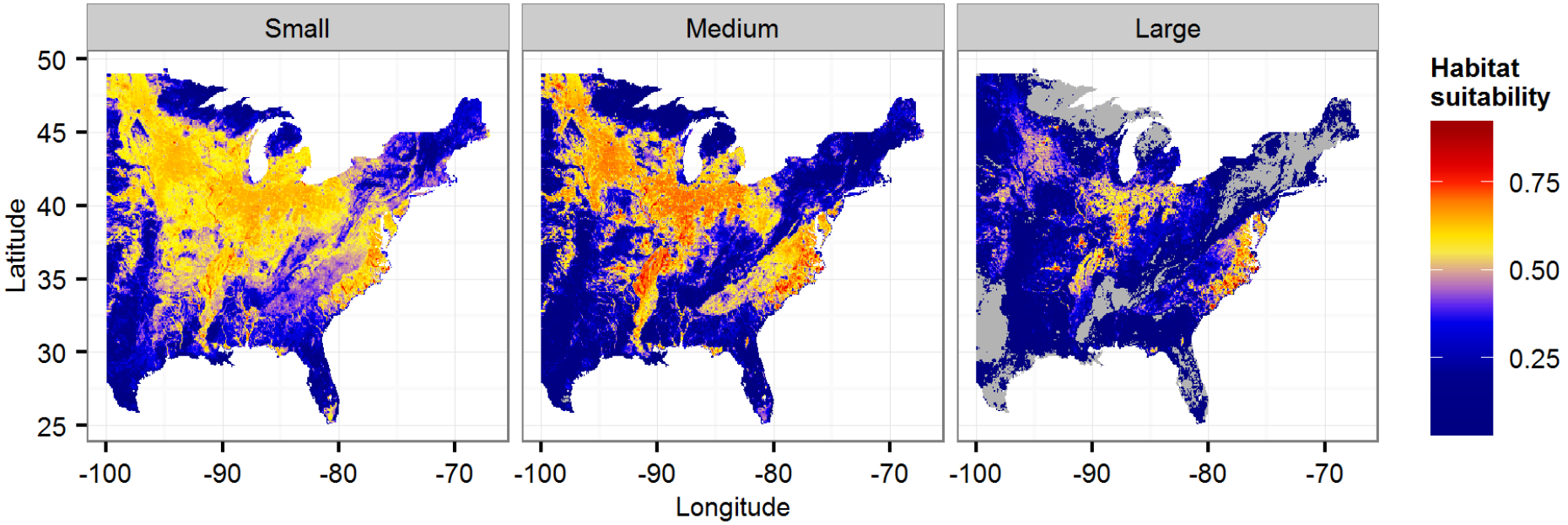


Results: Spring Migration Blitz

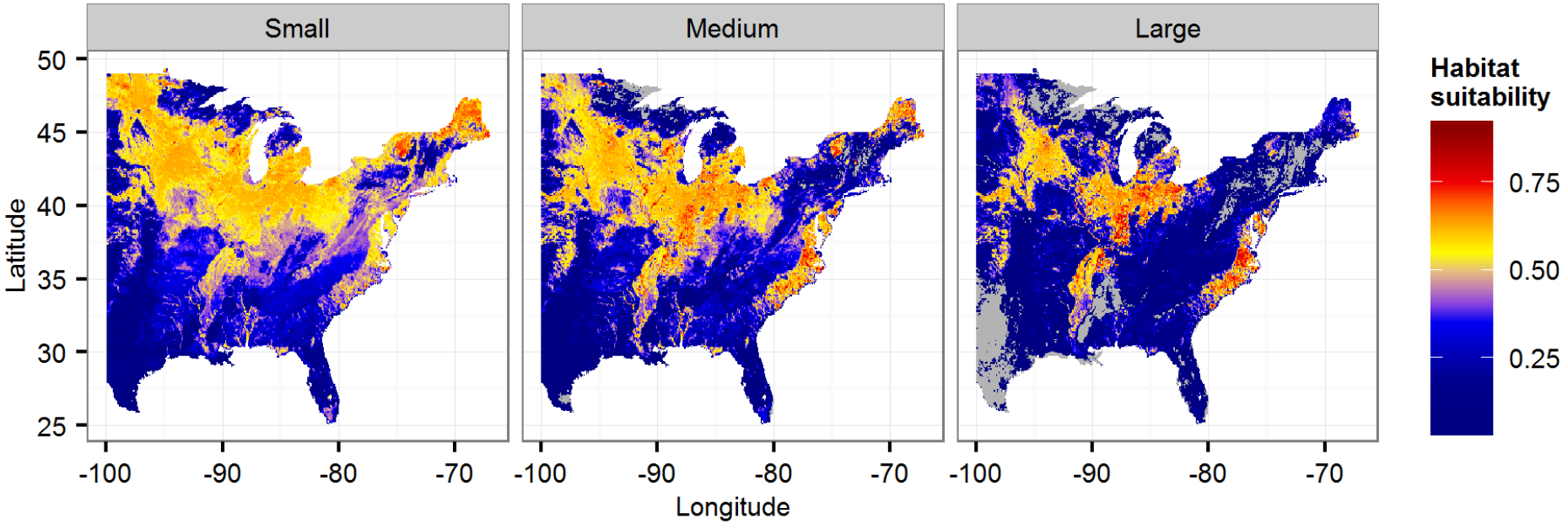
Period 1: March 1 - 11



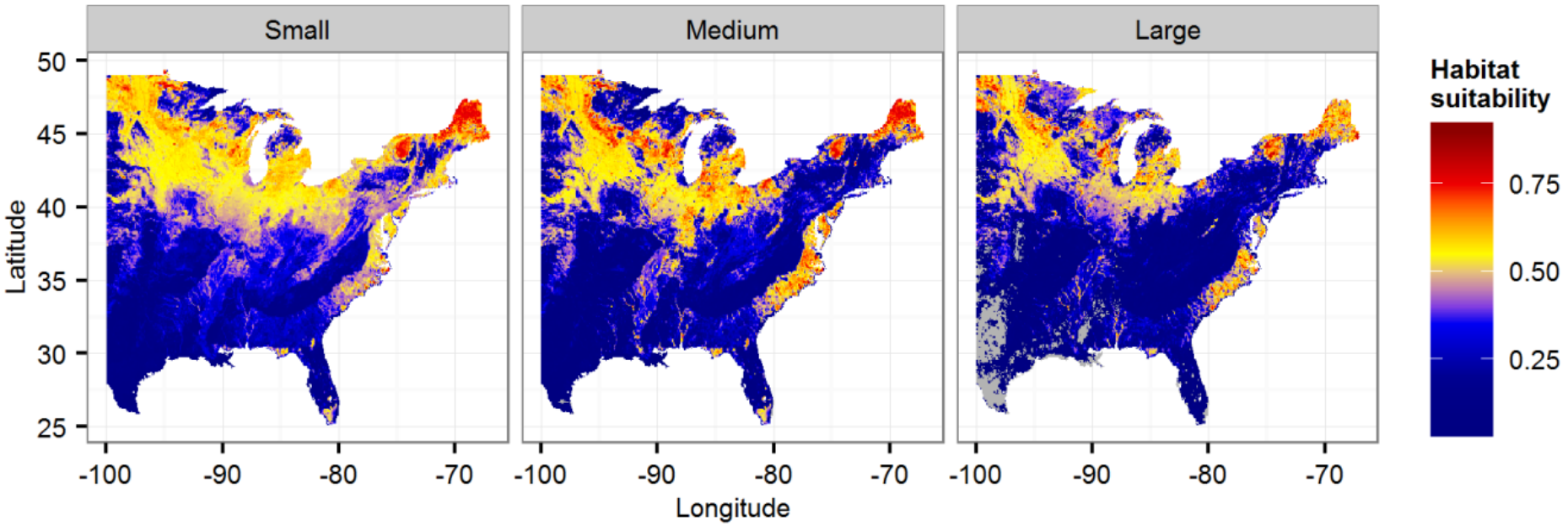
Period 2: March 12 - 25



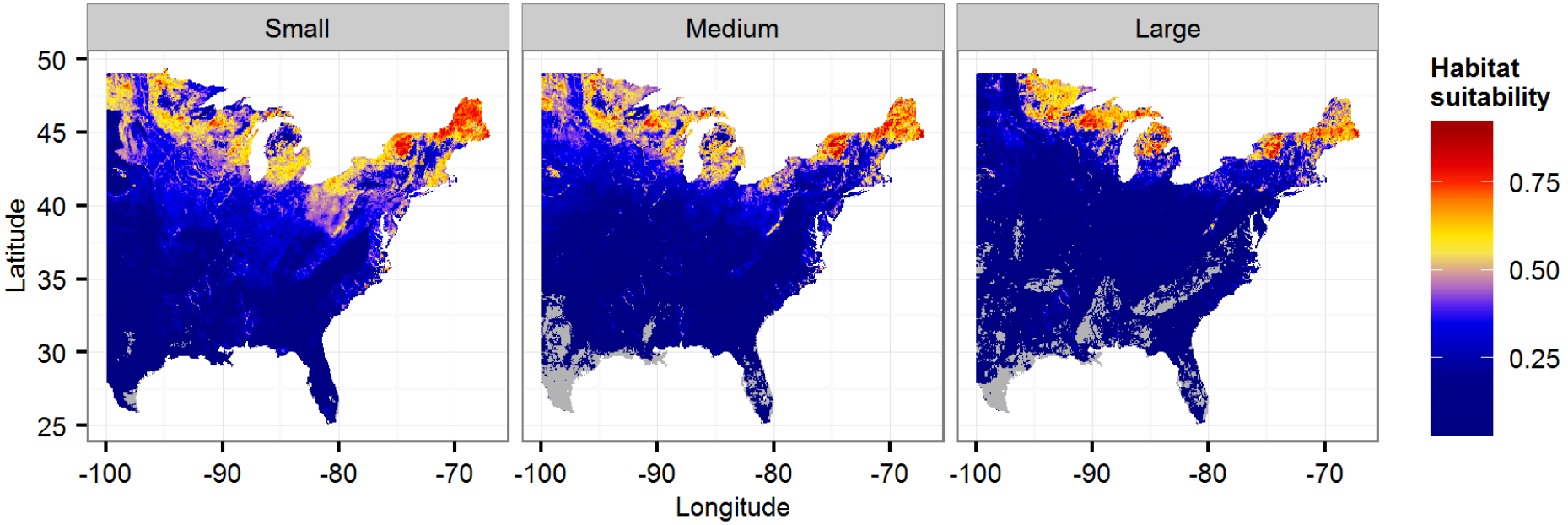
Period 3: March 26 – April 8

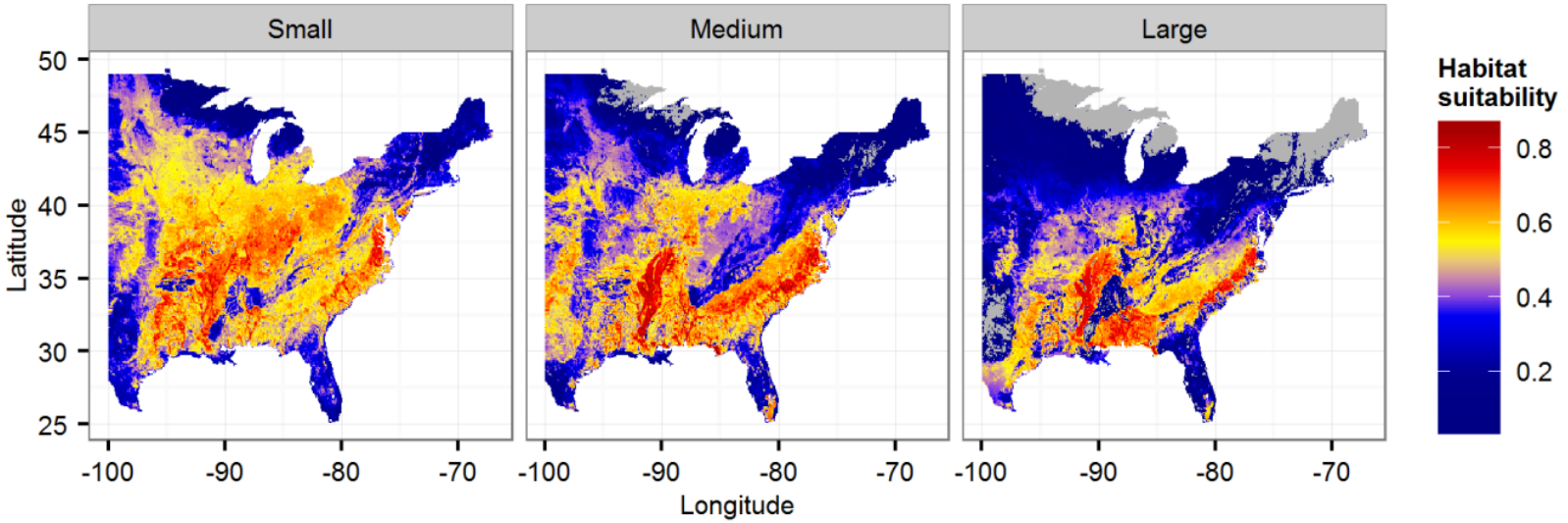


Period 4: April 9 – April 22



Period 5: April 23 – May 5





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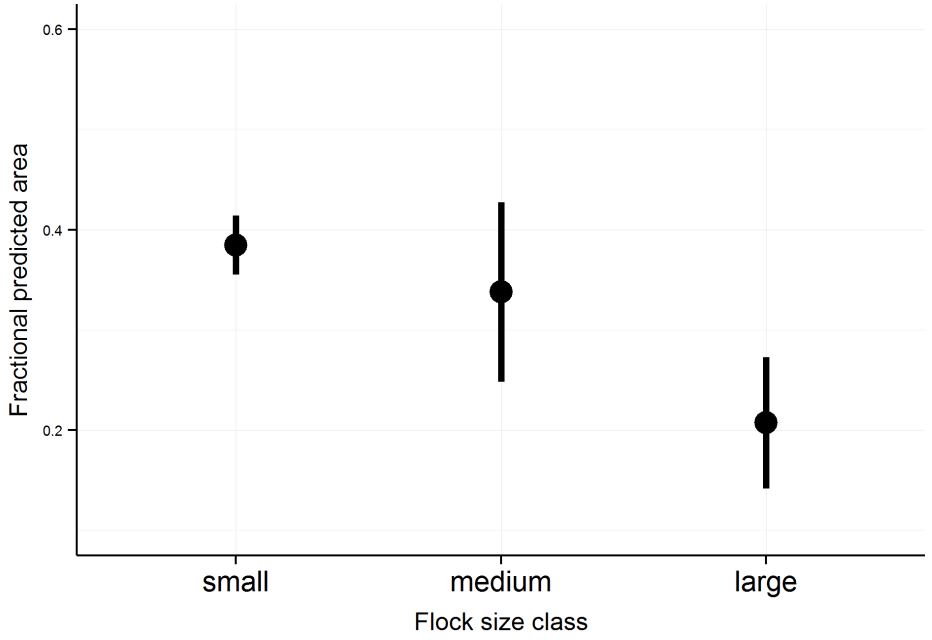

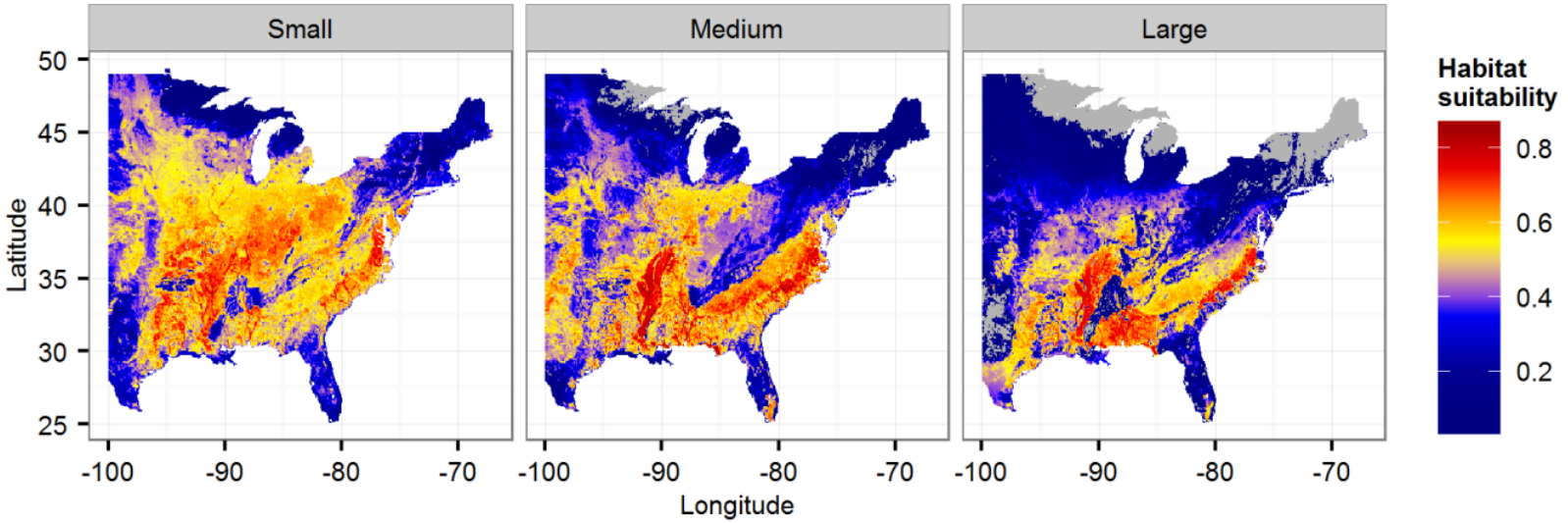
Small
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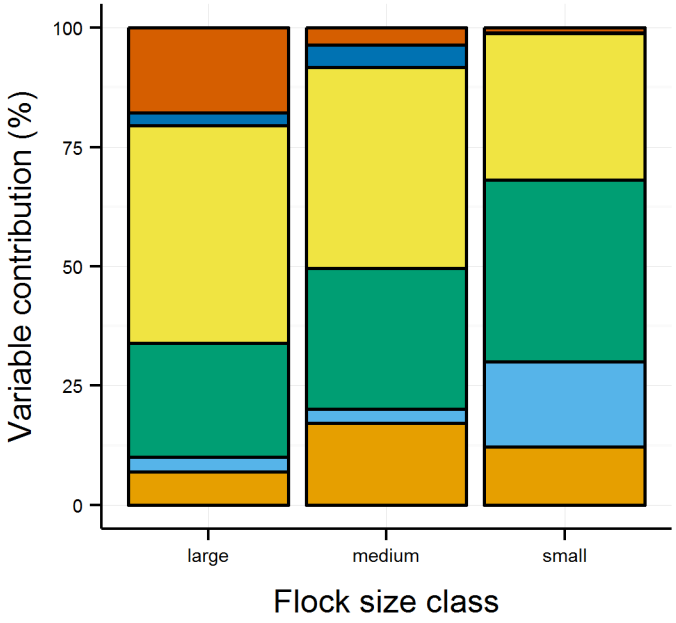
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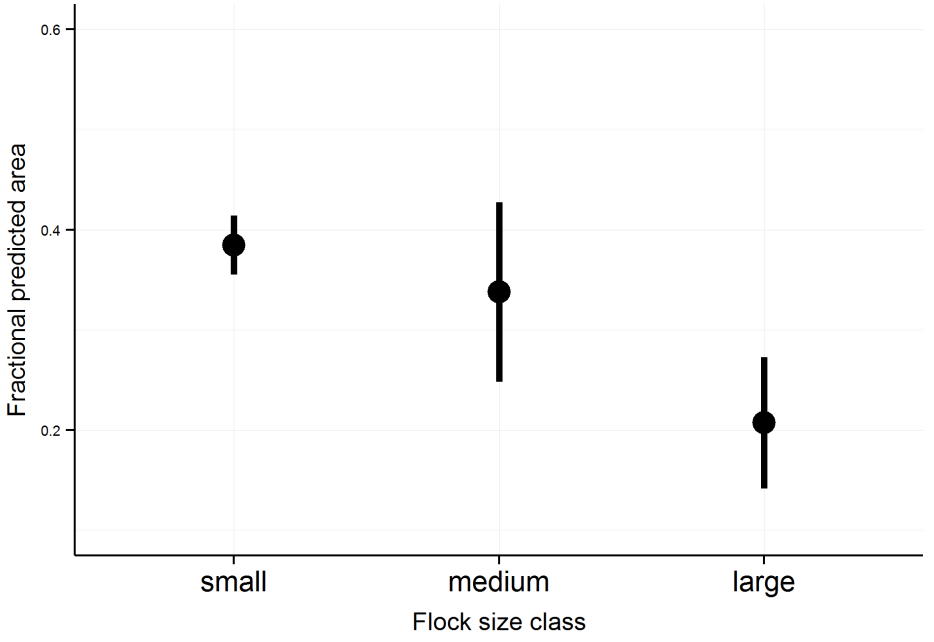
Flock size class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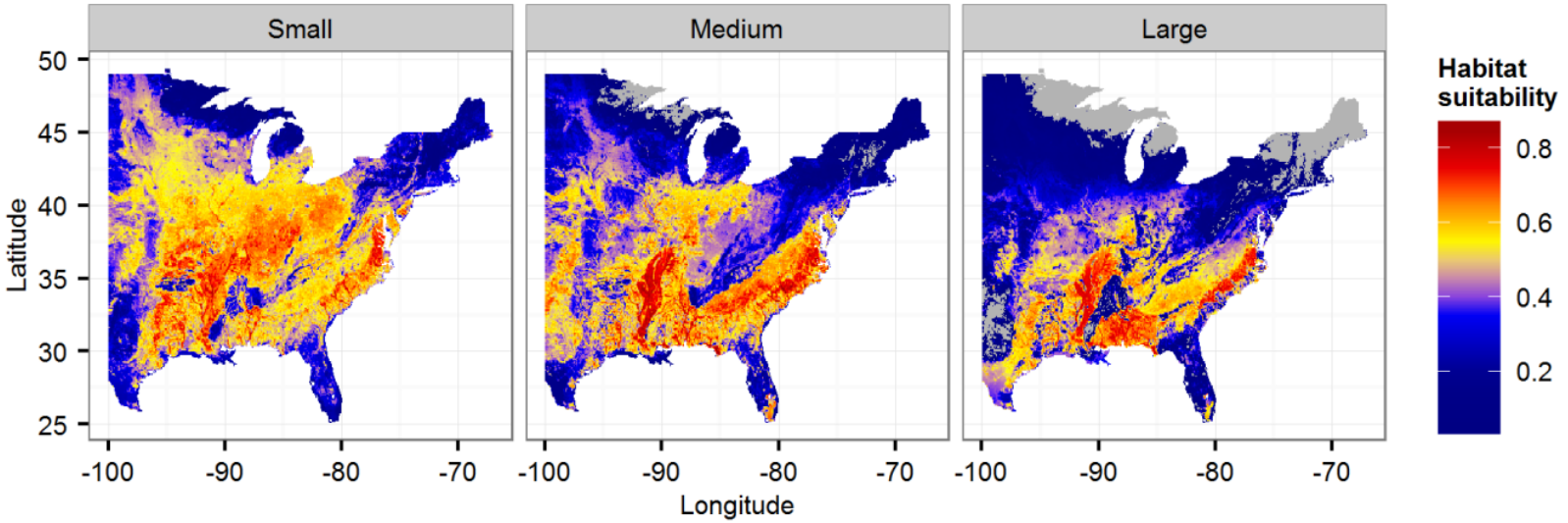
Flock size class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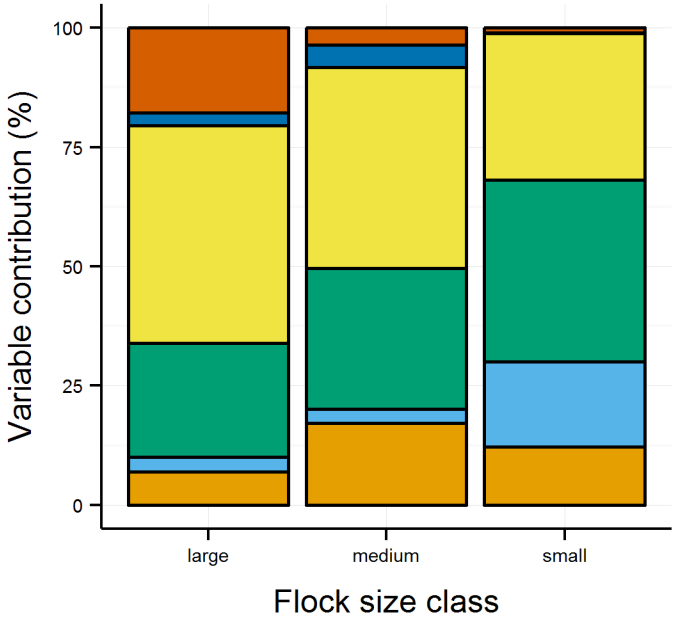
Variable contribution (%)
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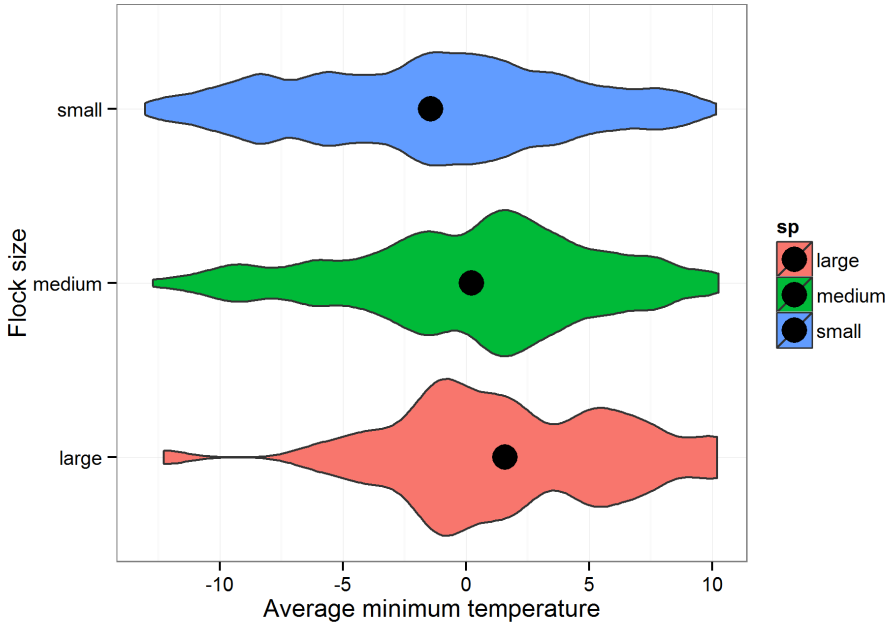
Flock size class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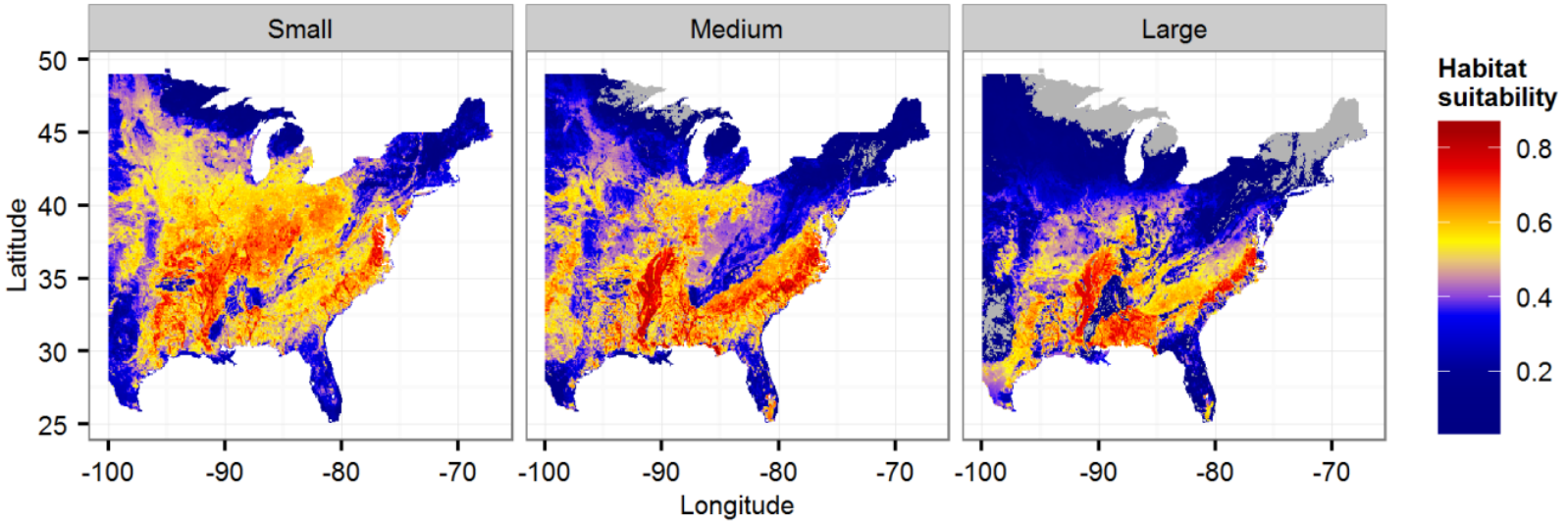
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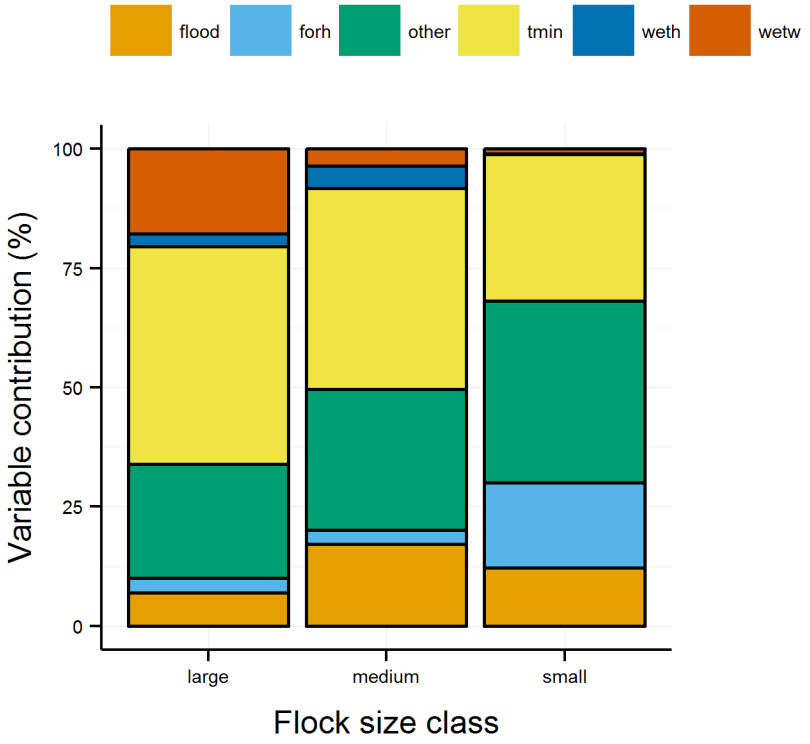
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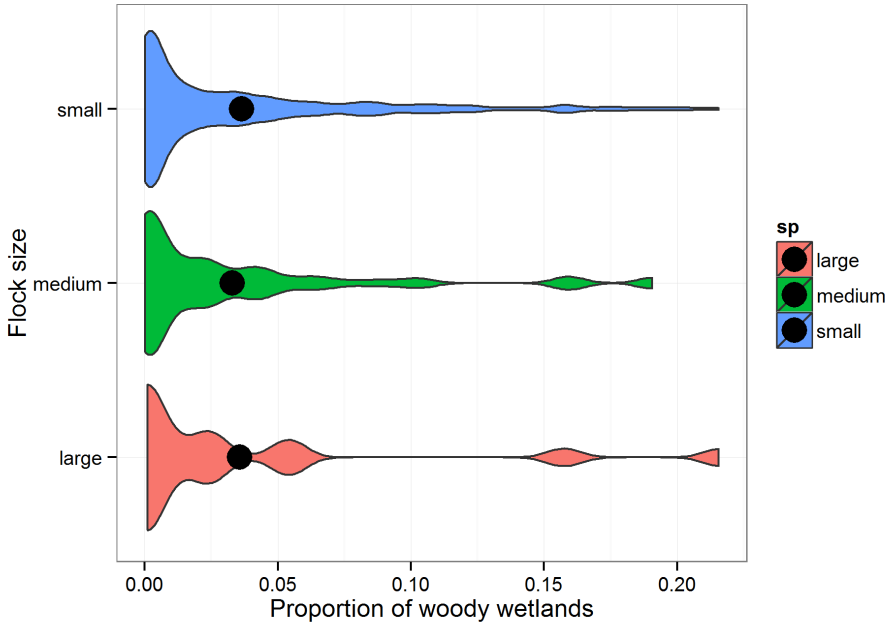
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Proportion of woody wetlands
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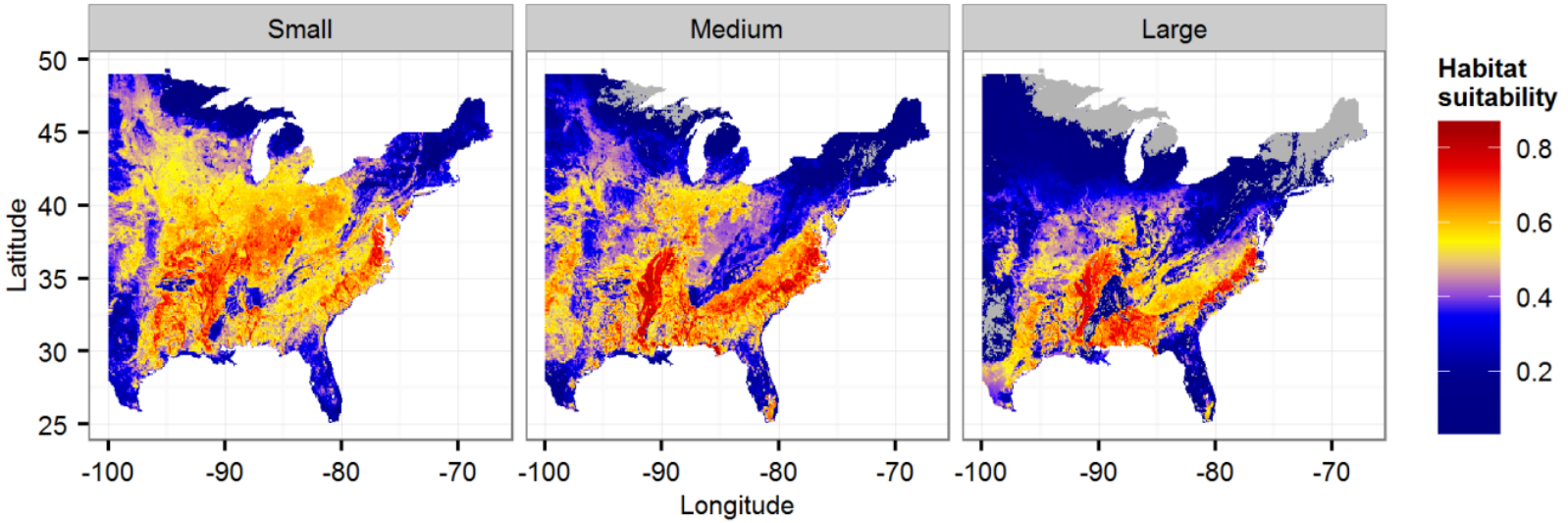
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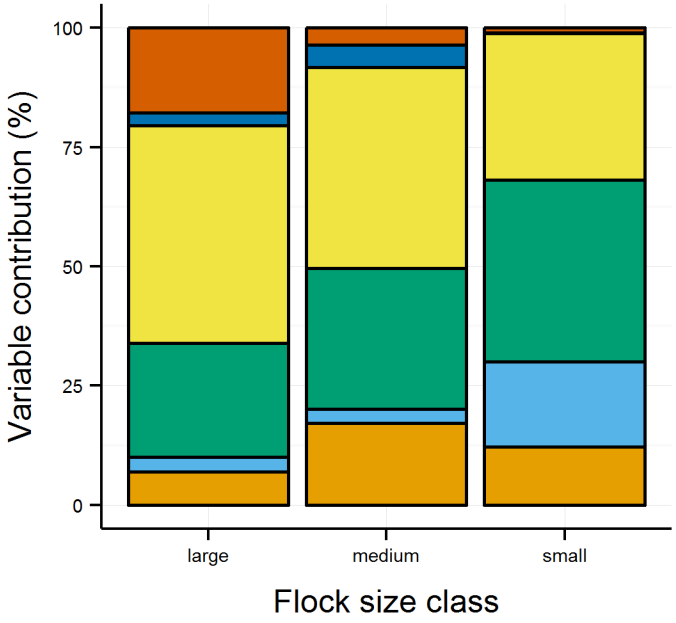
Variable contribution (%)
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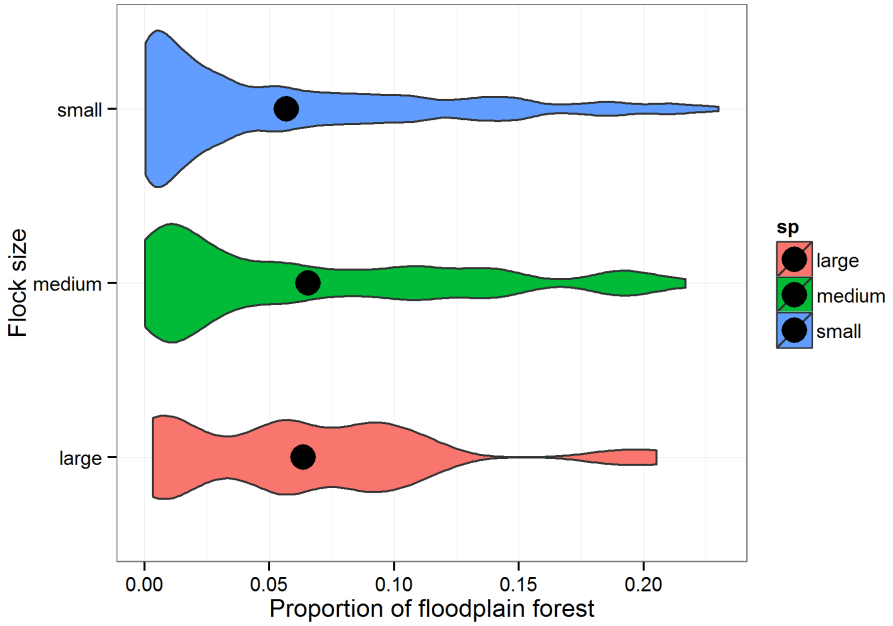
Flock size class


Flock size
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Proportion of floodplain forest
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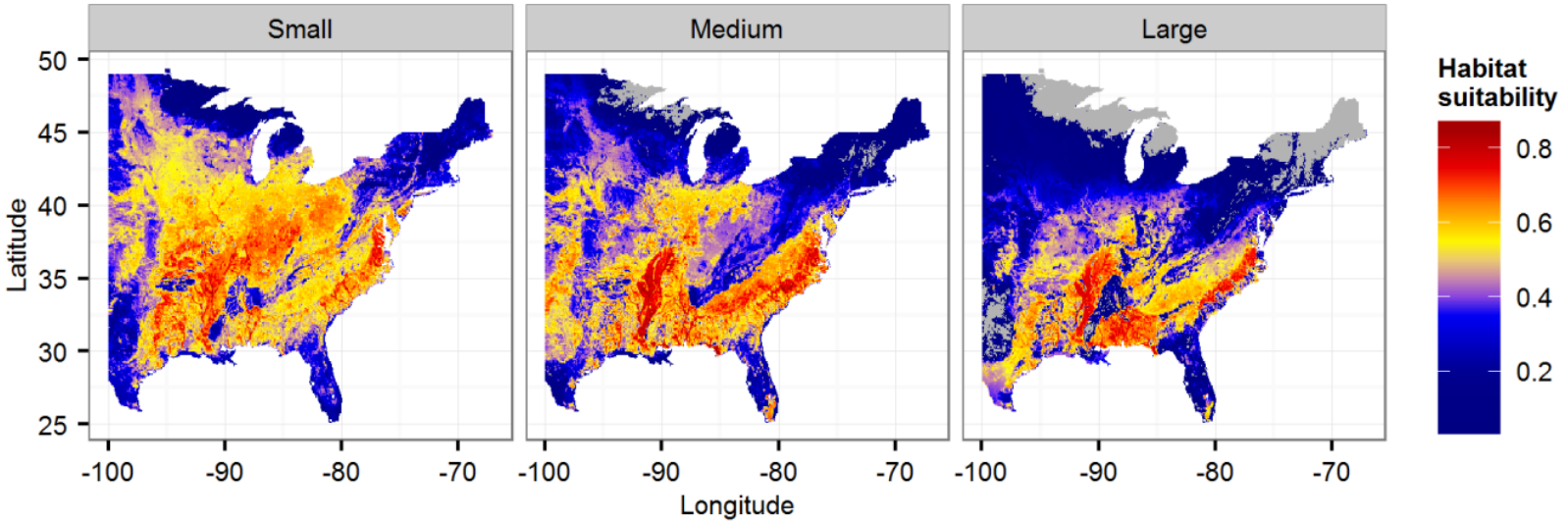
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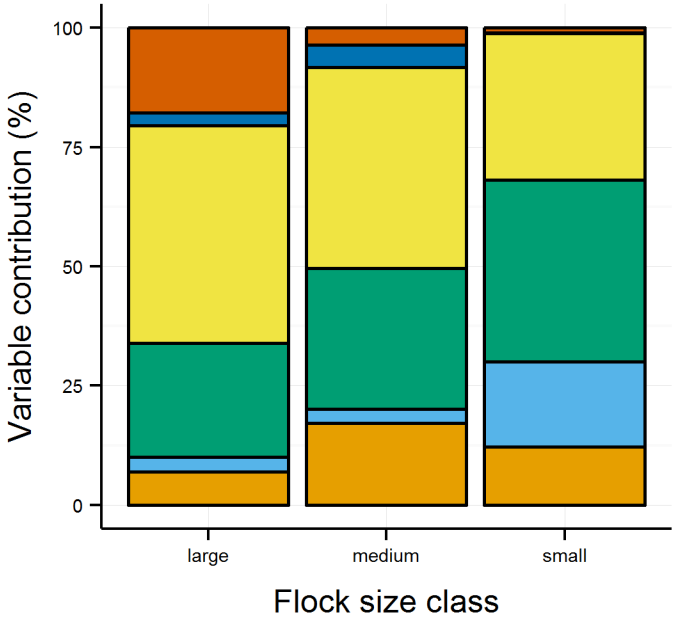
Variable contribution (%)
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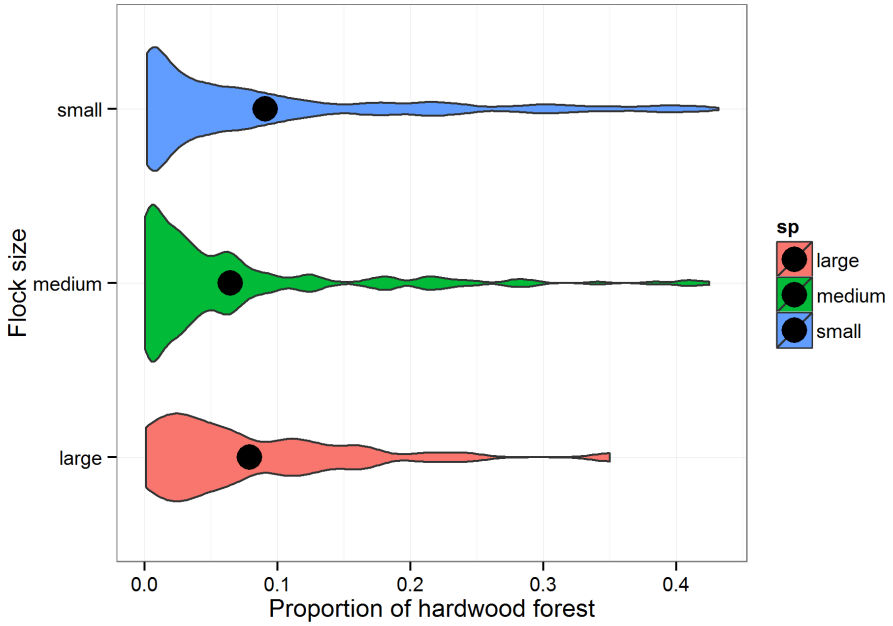
Flock size class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Proportion of hardwood forest
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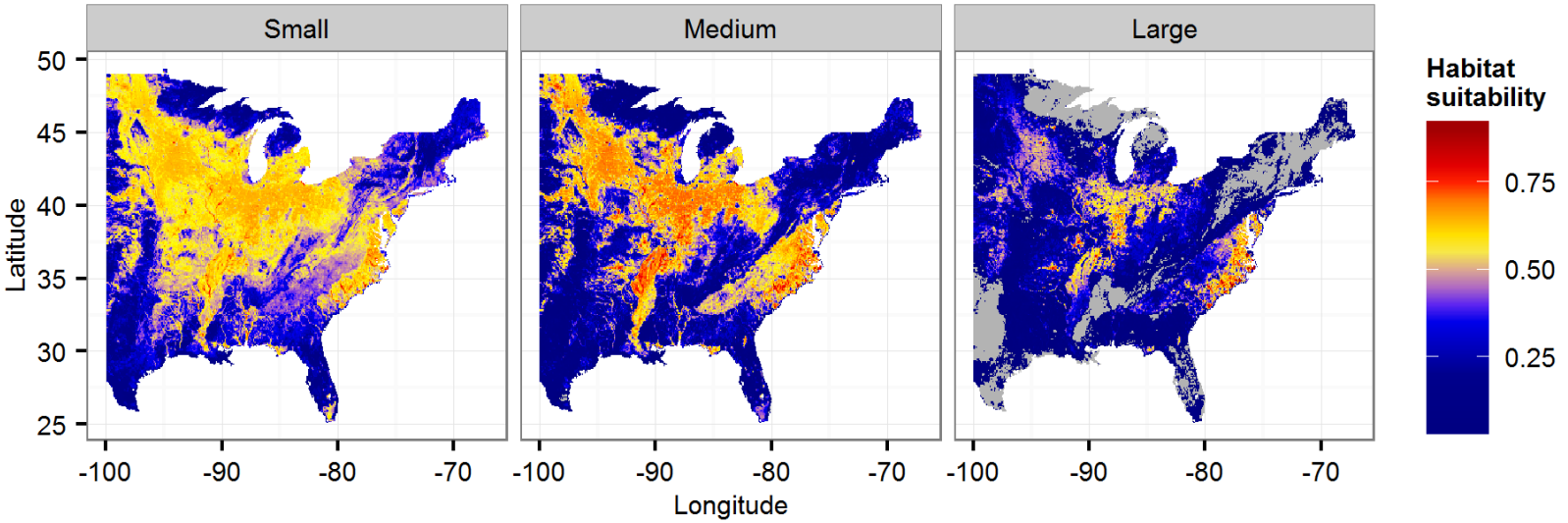
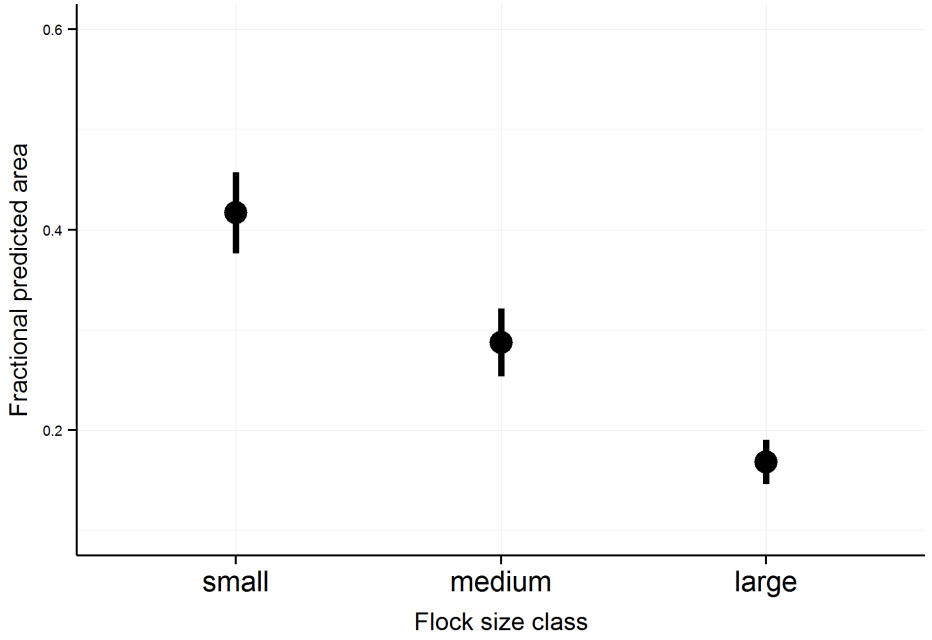
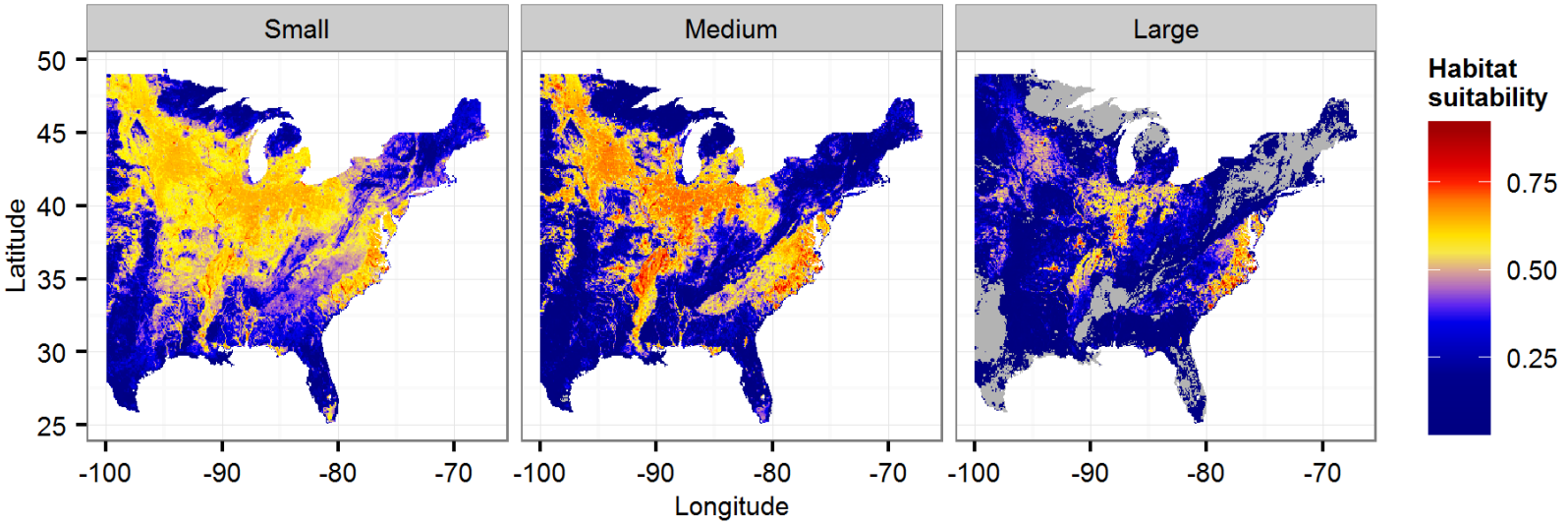
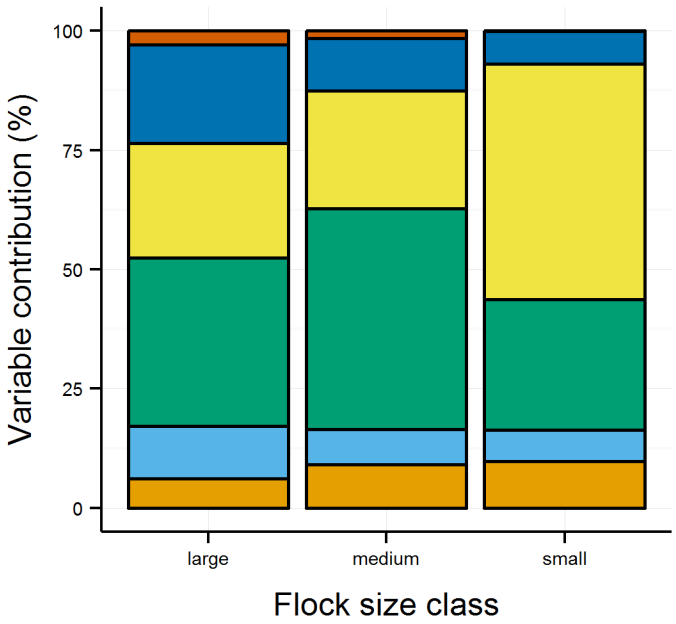


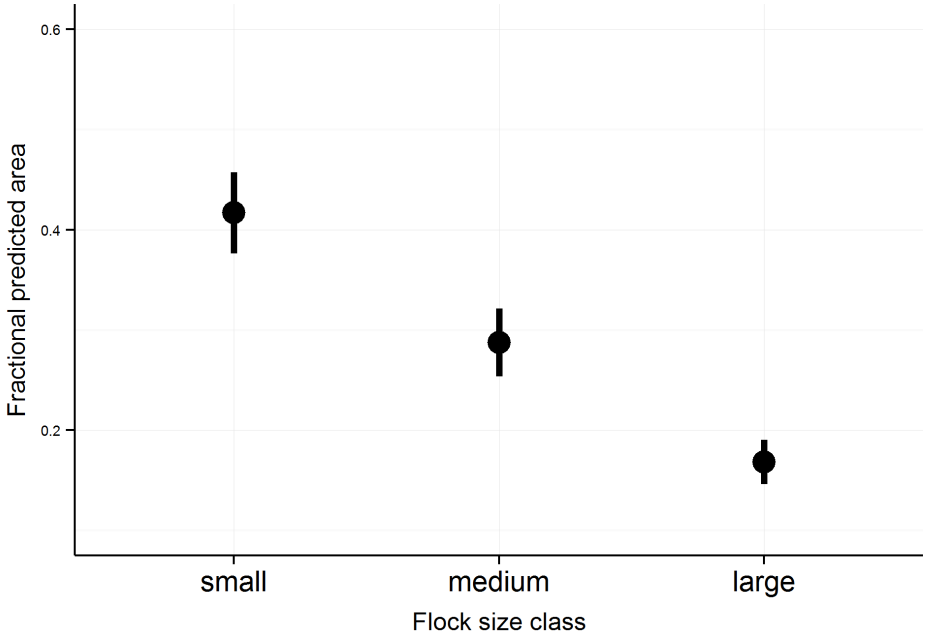
Period 2: March 12 - 25

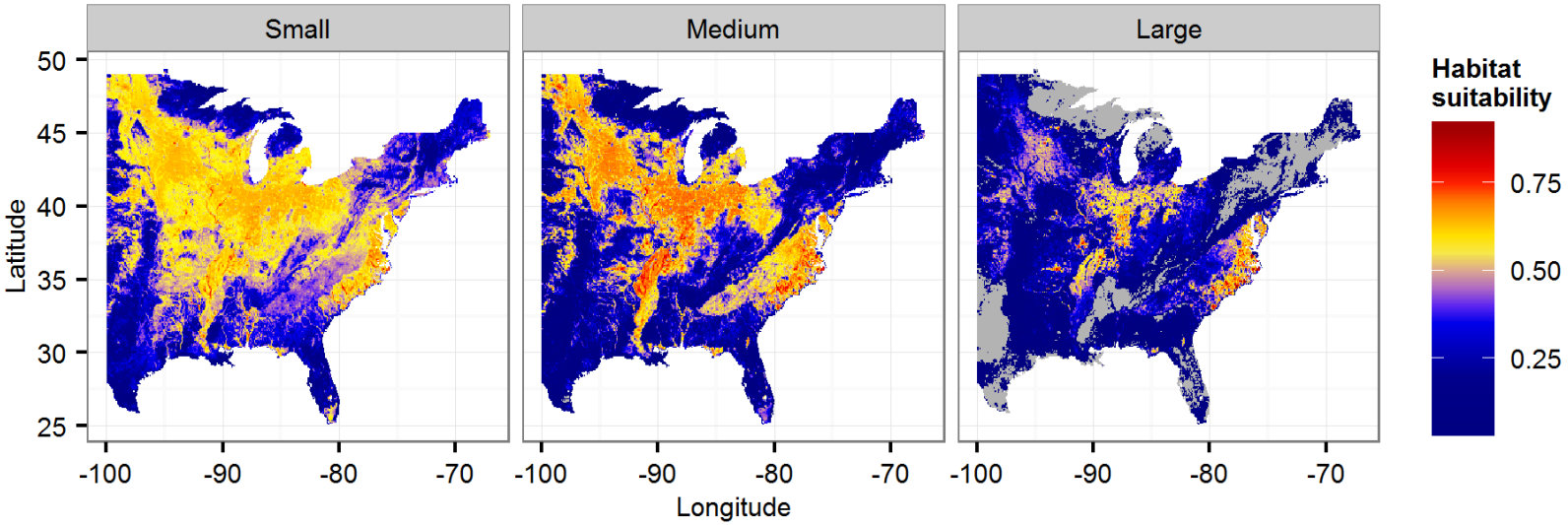



Small
Medium
Large
Habitat suitability
0.75
0.50
0.25
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70

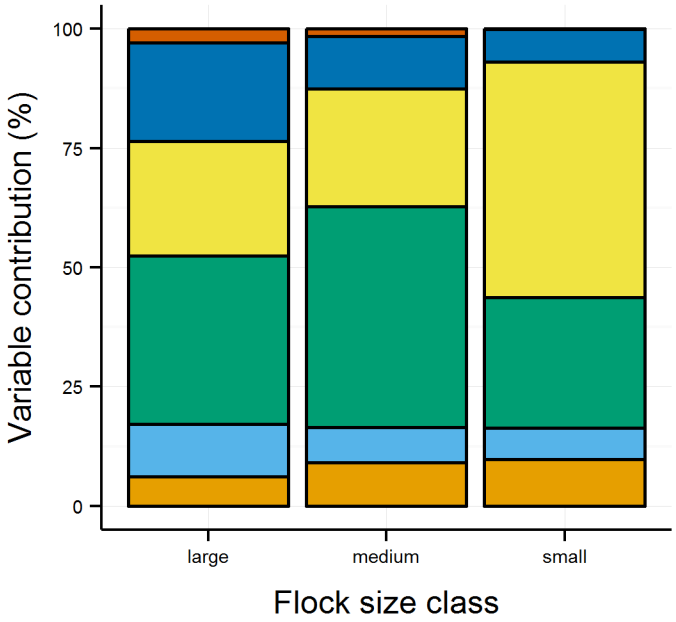

flood
forh
other
tmin
weth
wetw

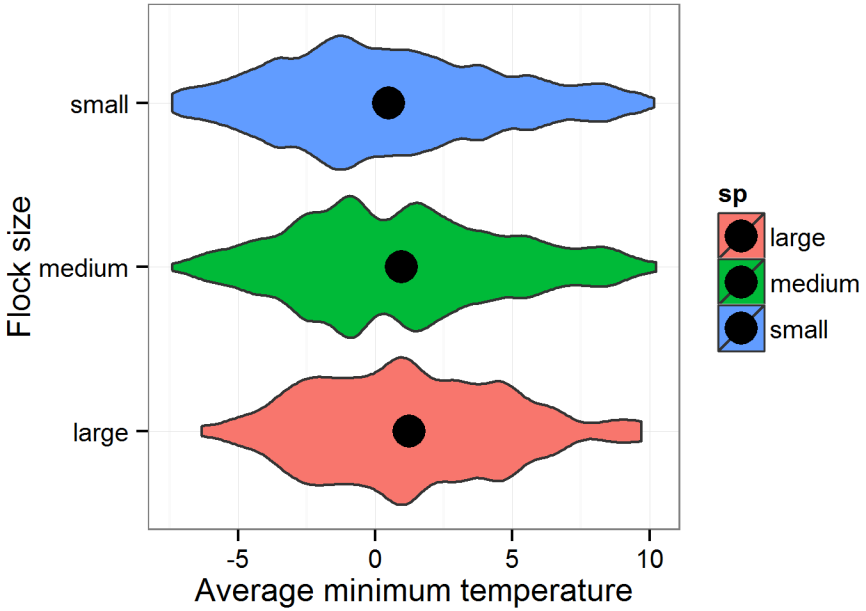

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

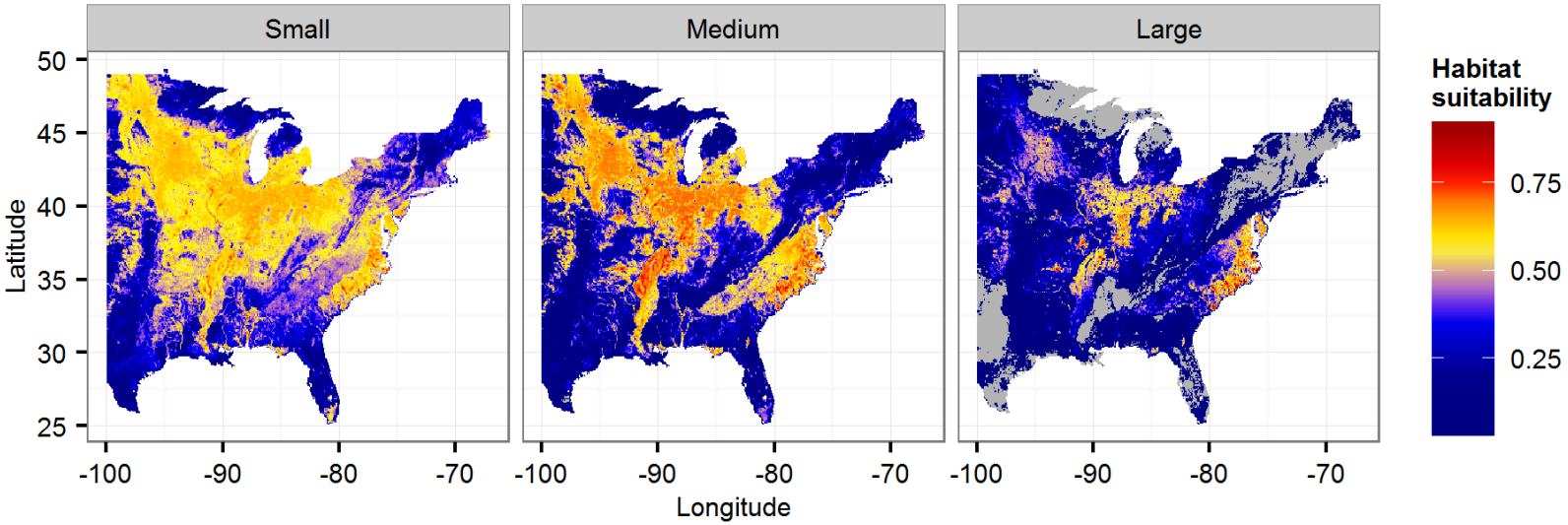

Fractional predicted area
0.6
0.4
0.2
small
medium
large
Flock size class


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

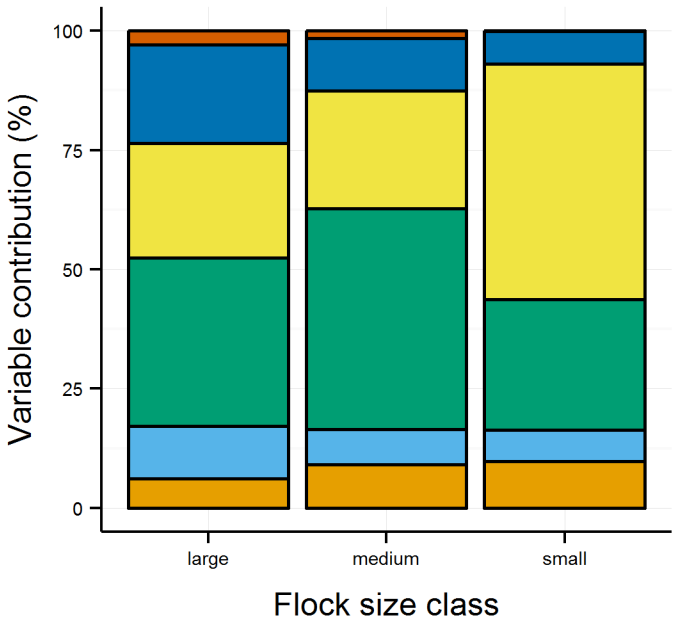

flood
forh
other
tmin
weth
wetw

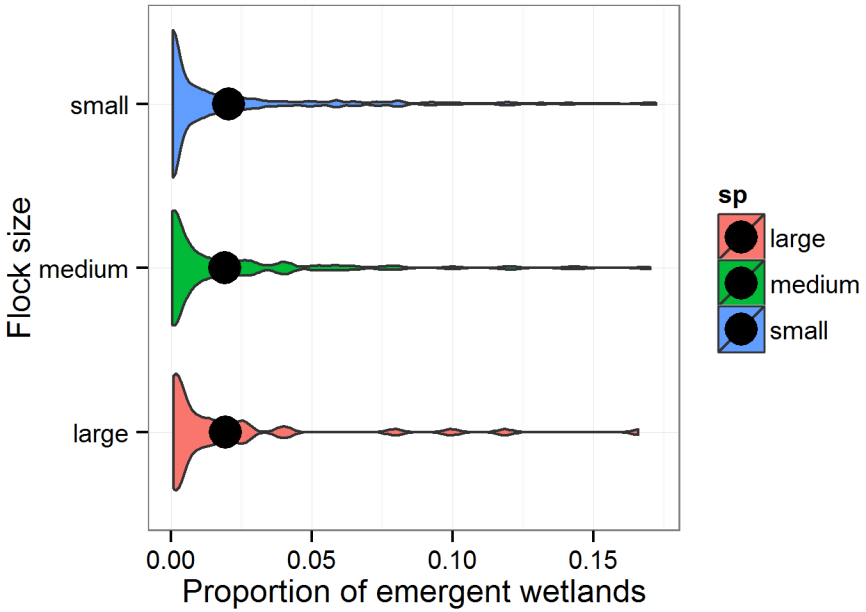

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

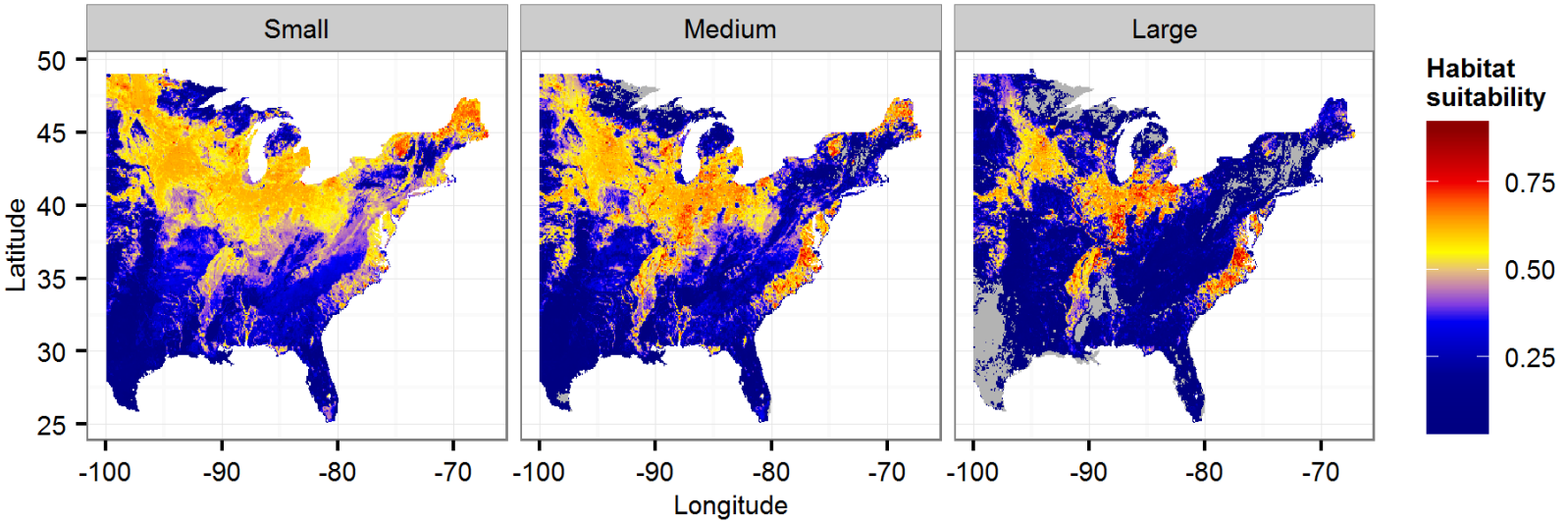

Flock size
small
medium
large
-5
0
5
10
Average minimum temperature
sp
large
medium
small


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

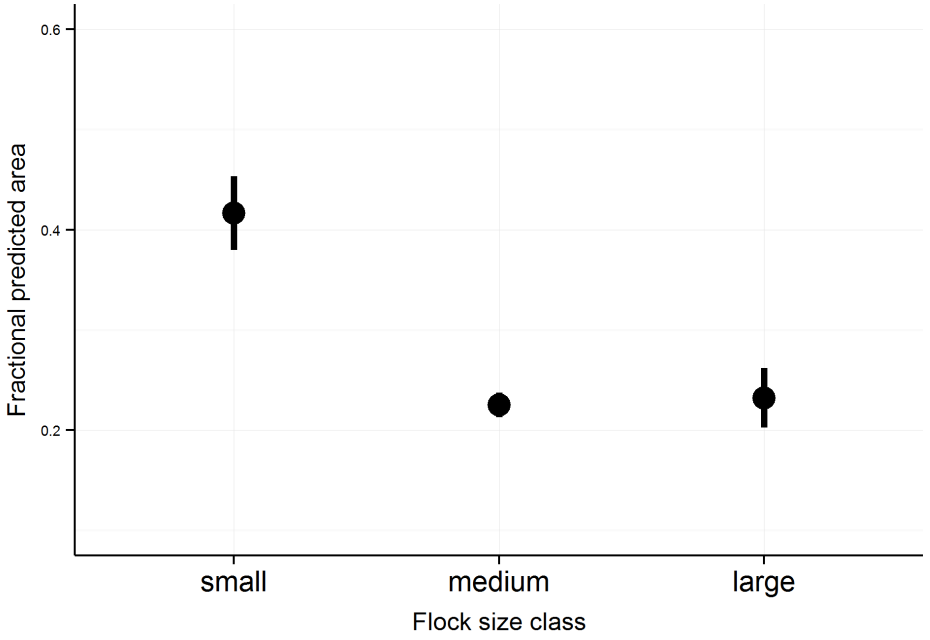

flood
forh
other
tmin
weth
wetw

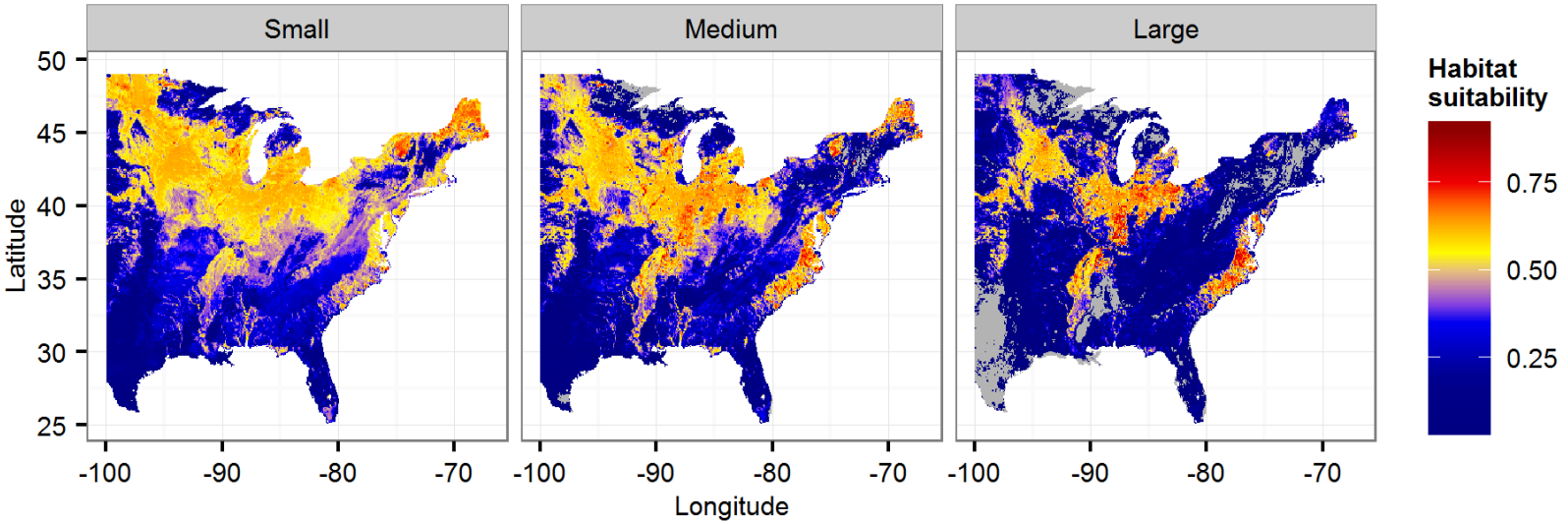

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class


Flock size
small
medium
large
0.00
0.05
0.10
0.15
Proportion of emergent wetlands
sp
large
medium
small

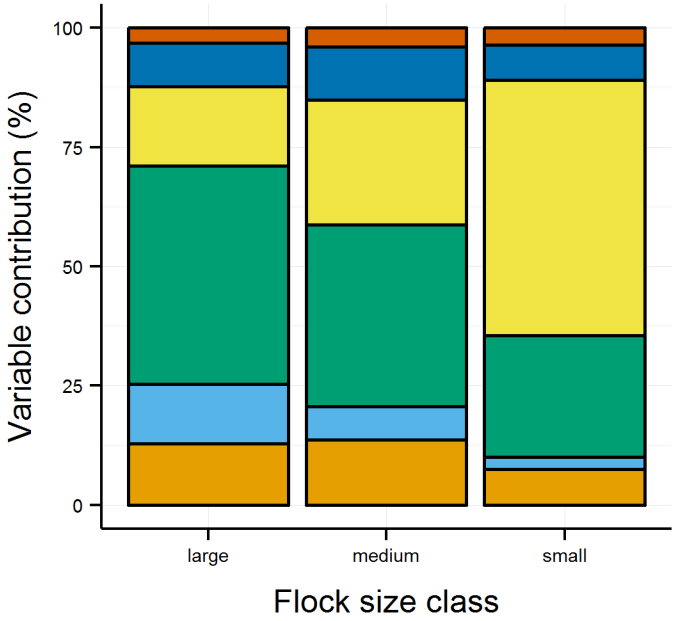


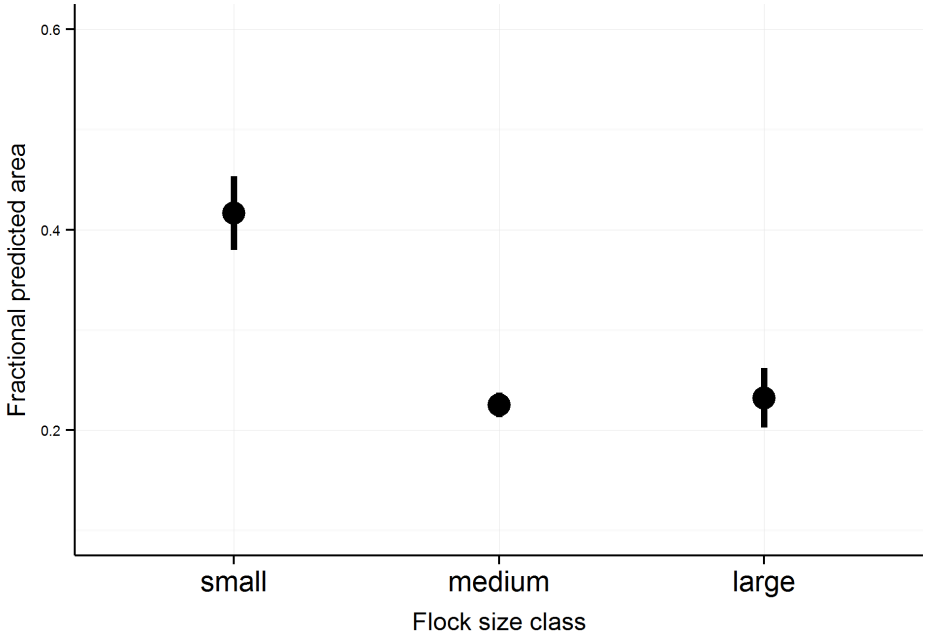
Period 3: March 26 – April 8

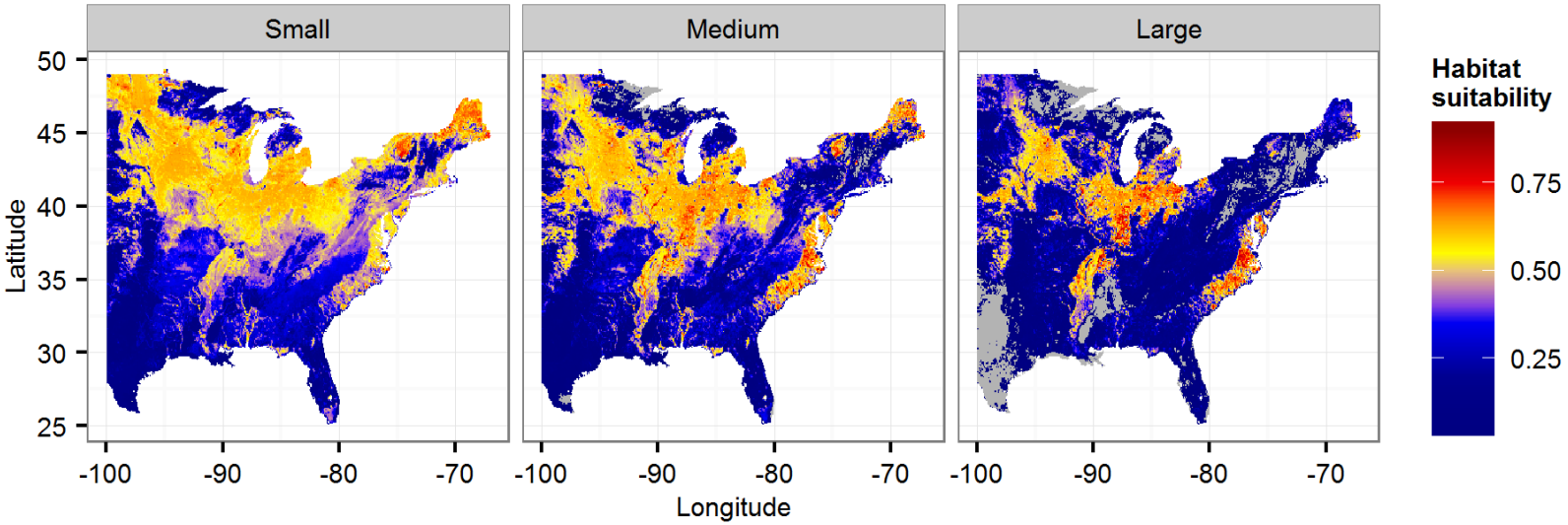



Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

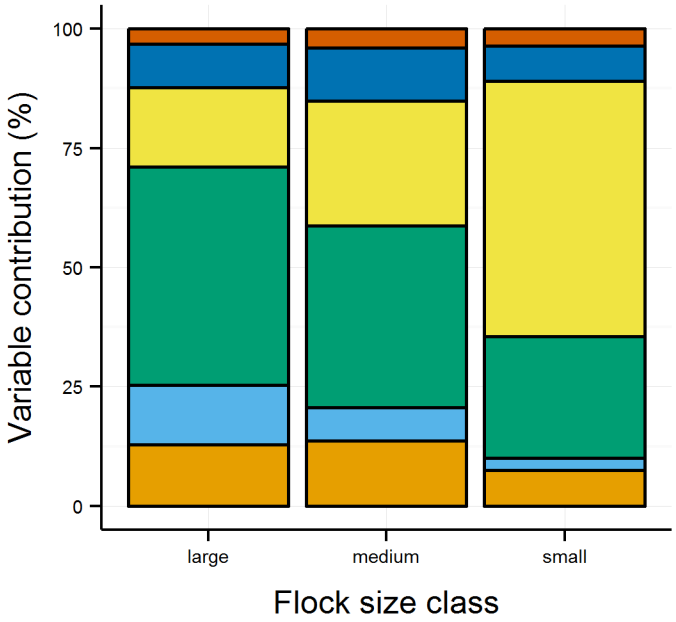

flood
forh
other
tmin
weth
wetw

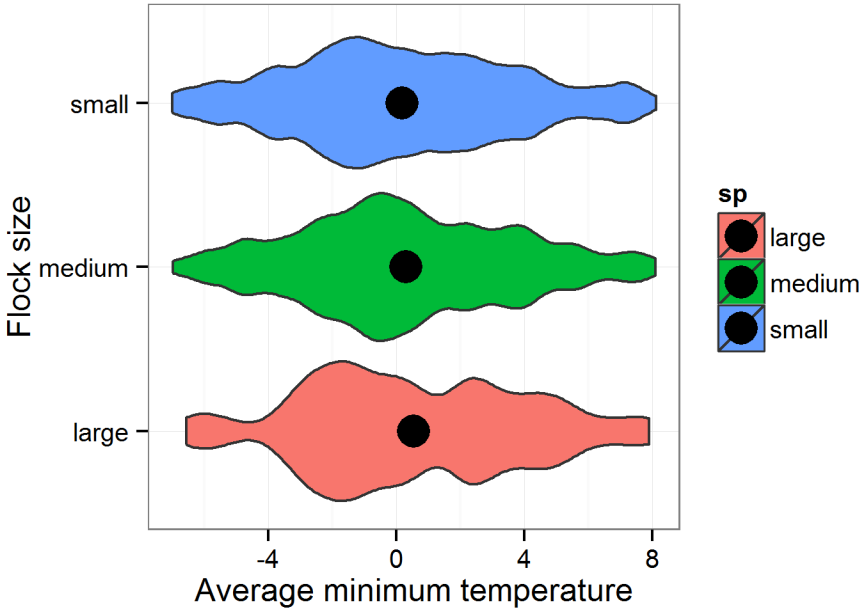

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

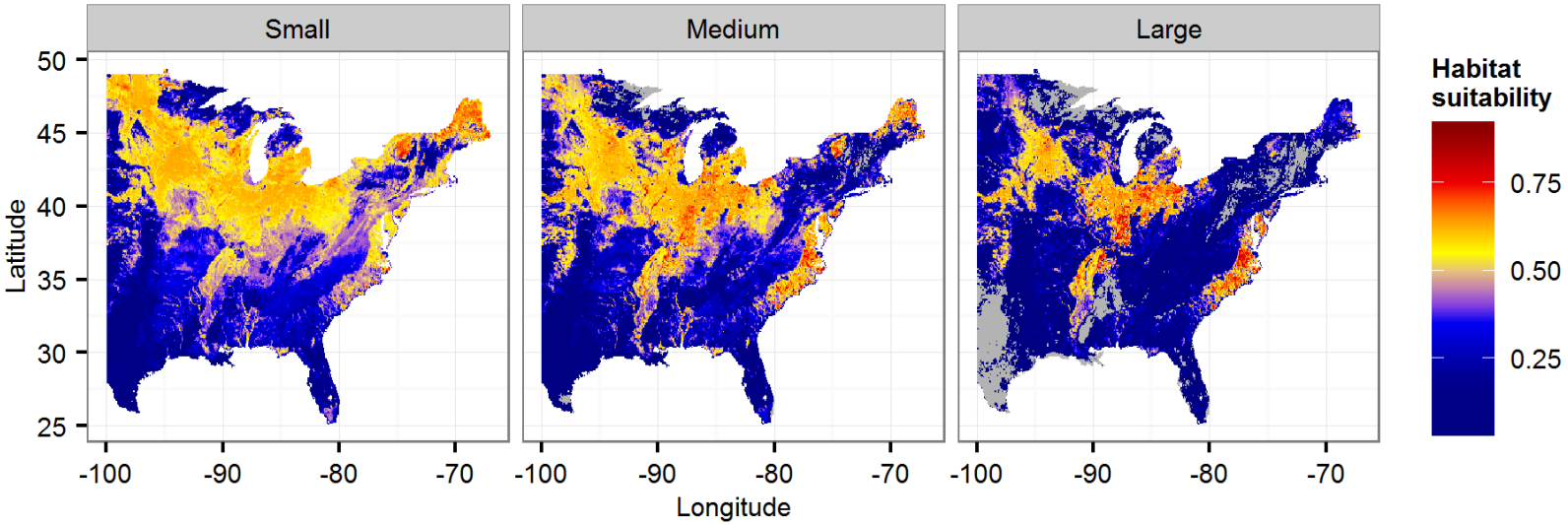

Fractional predicted area
0.6
0.4
0.2
small
medium
large
Flock size class


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

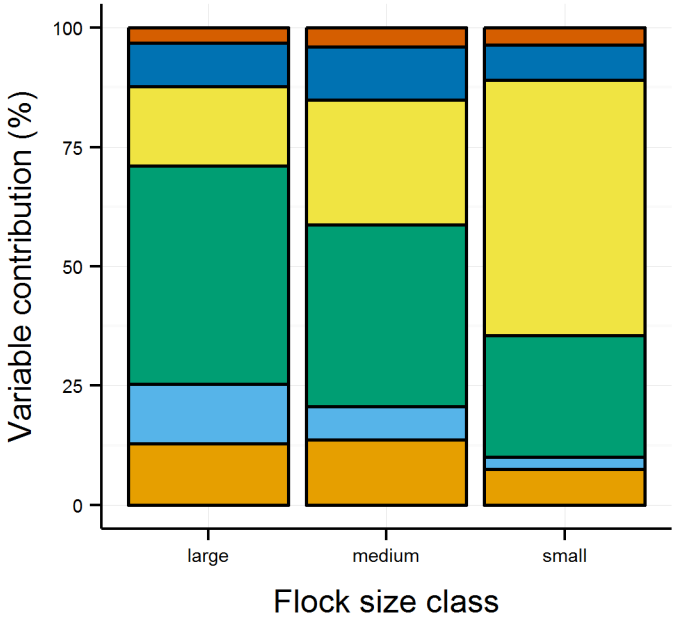

flood
forh
other
tmin
weth
wetw

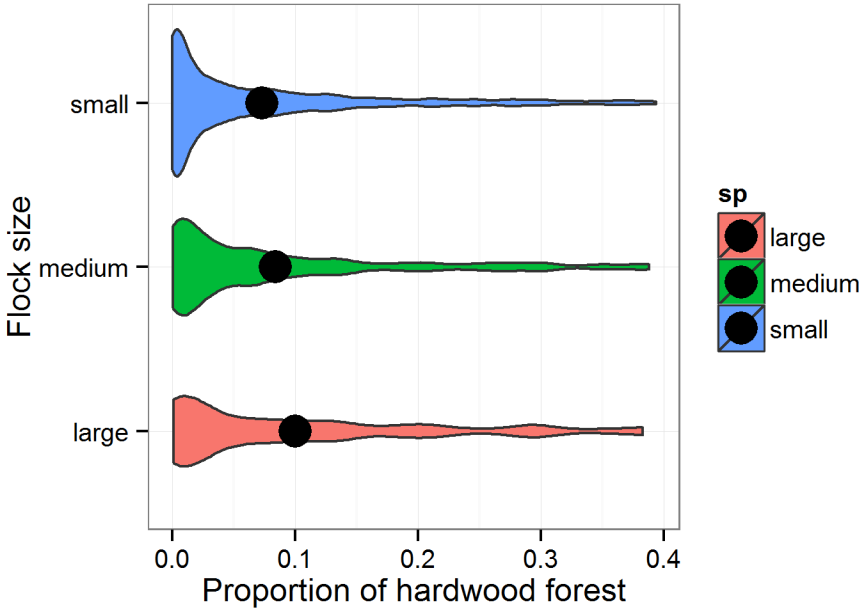

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

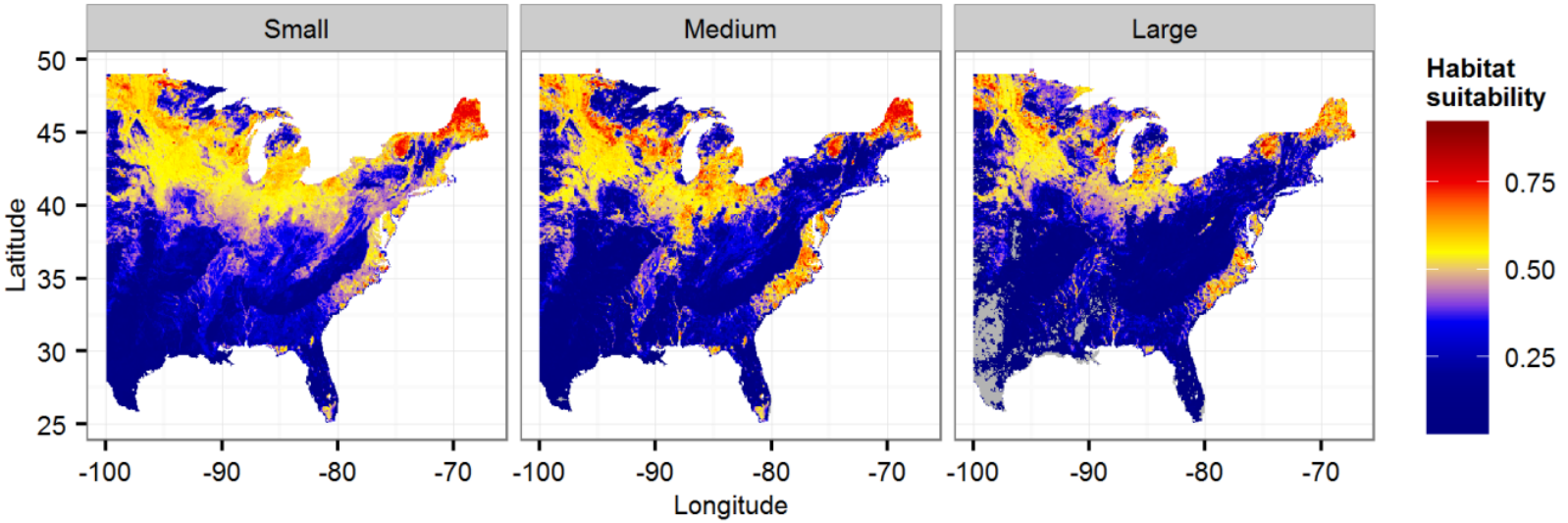

Flock size
small
medium
large
-4
0
4
8
Average minimum temperature
sp
large
medium
small


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

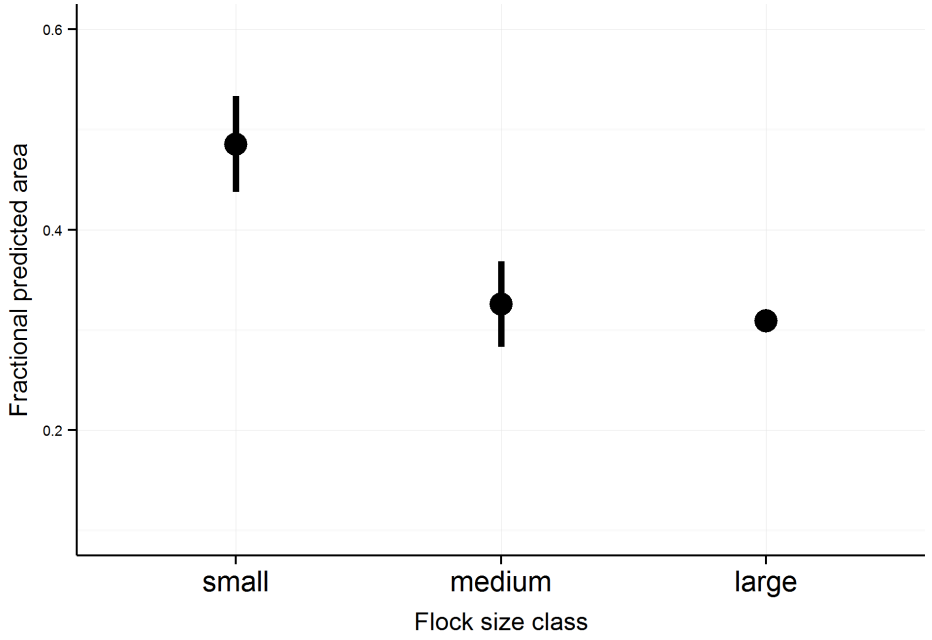

flood
forh
other
tmin
weth
wetw

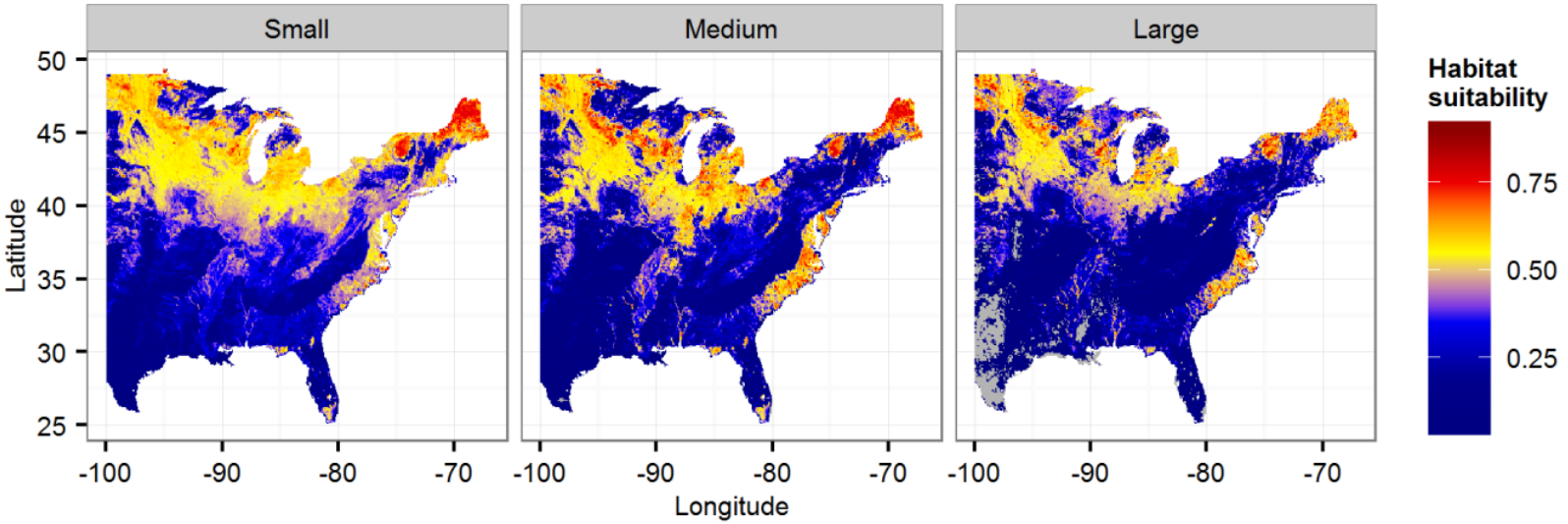

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class


Flock size
small
medium
large
0.0
0.1
0.2
0.3
0.4
Proportion of hardwood forest
sp
large
medium
small

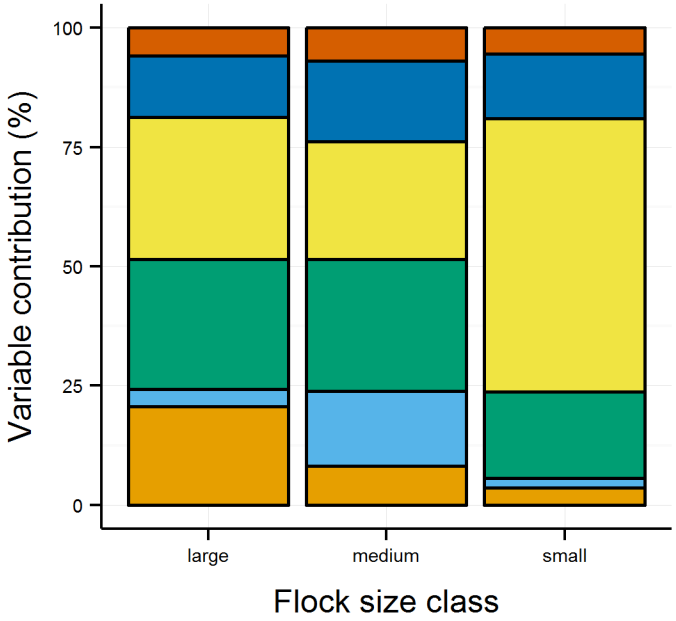


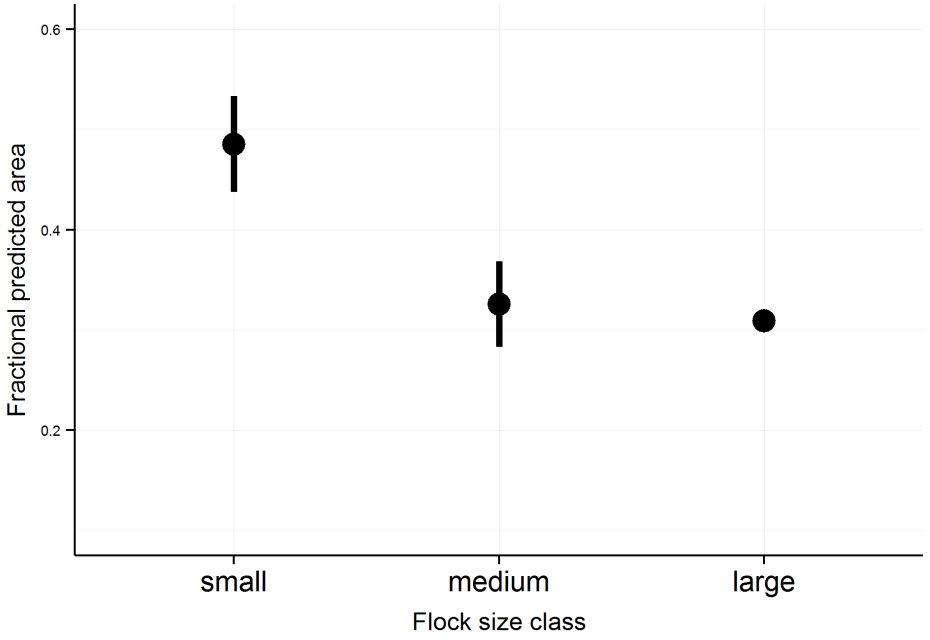
Period 4: April 9 – April 22

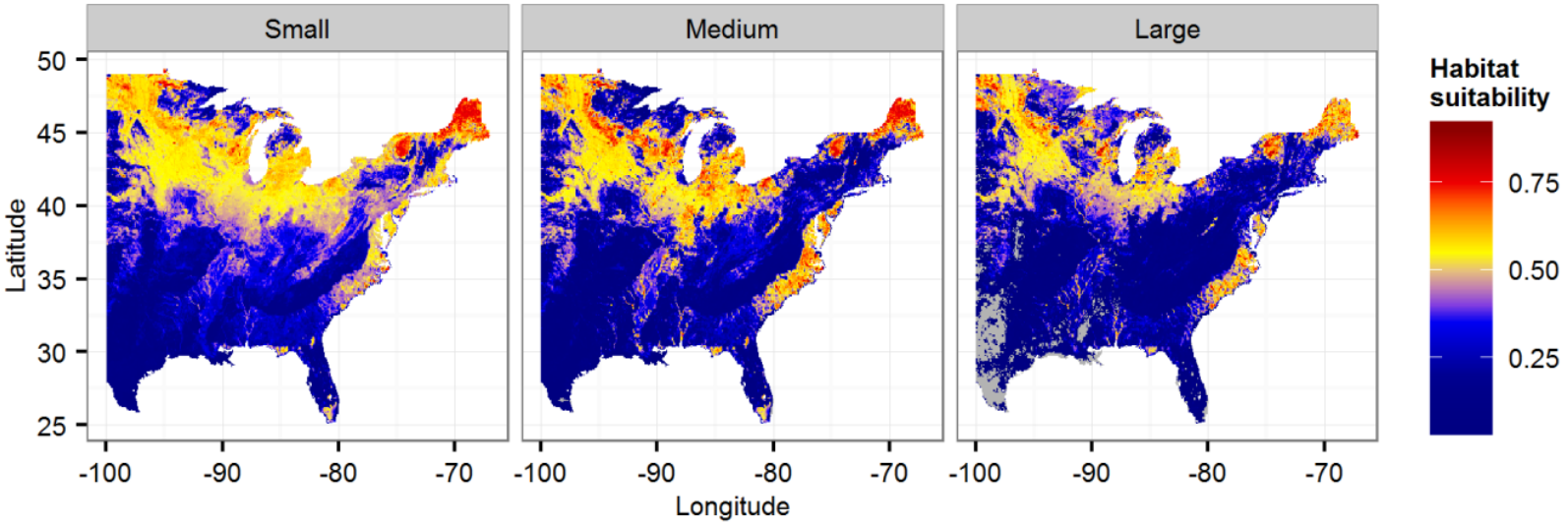



Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

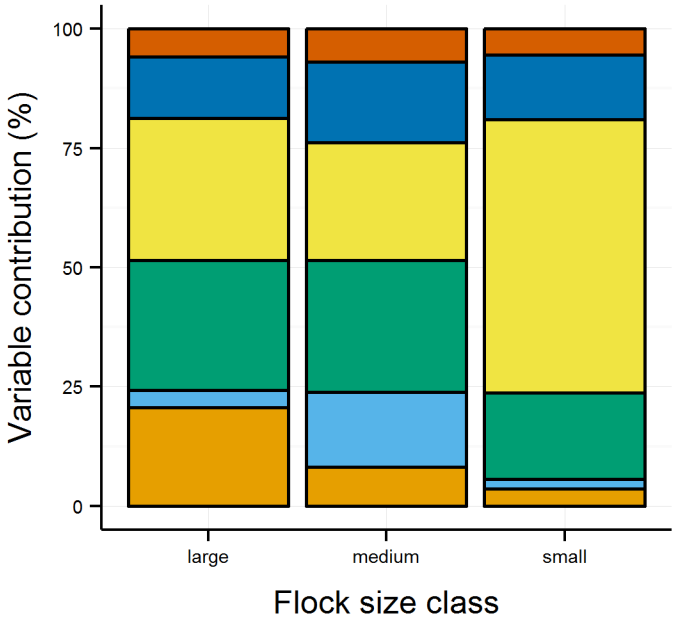

flood
forh
other
tmin
weth
wetw

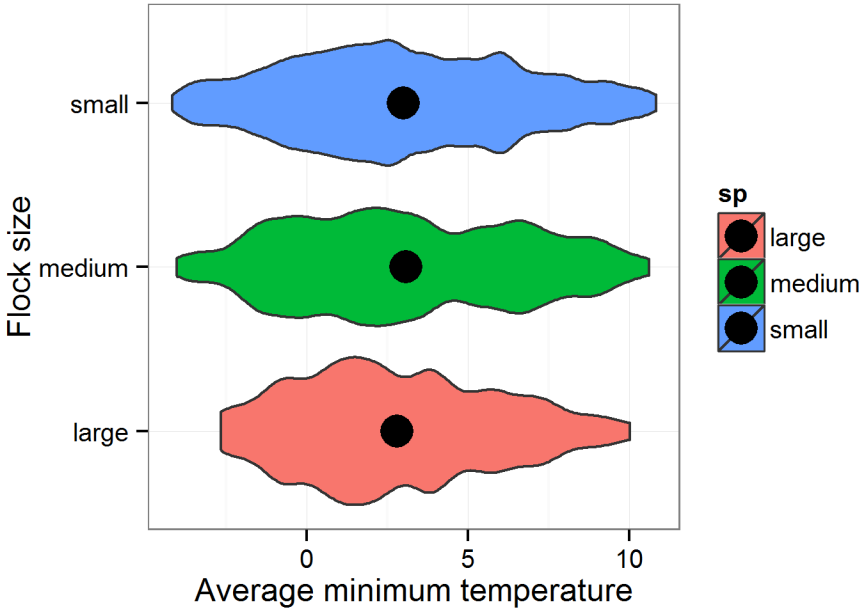

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

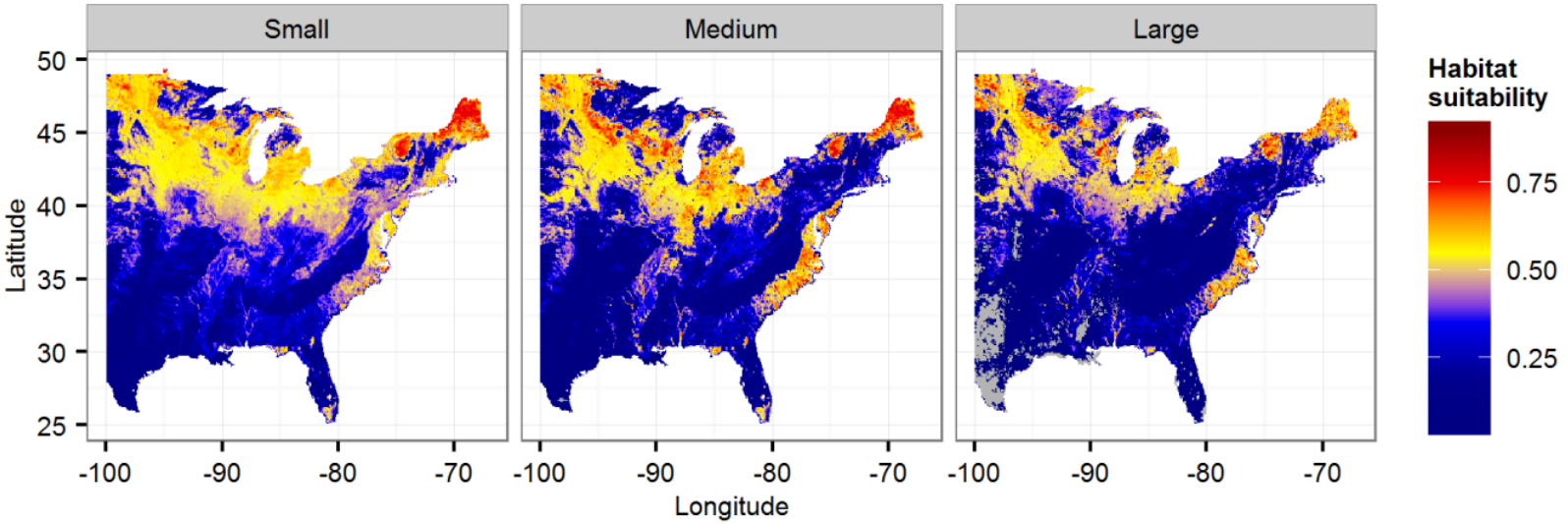

Fractional predicted area
0.6
0.4
0.2
small
medium
large
Flock size class


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

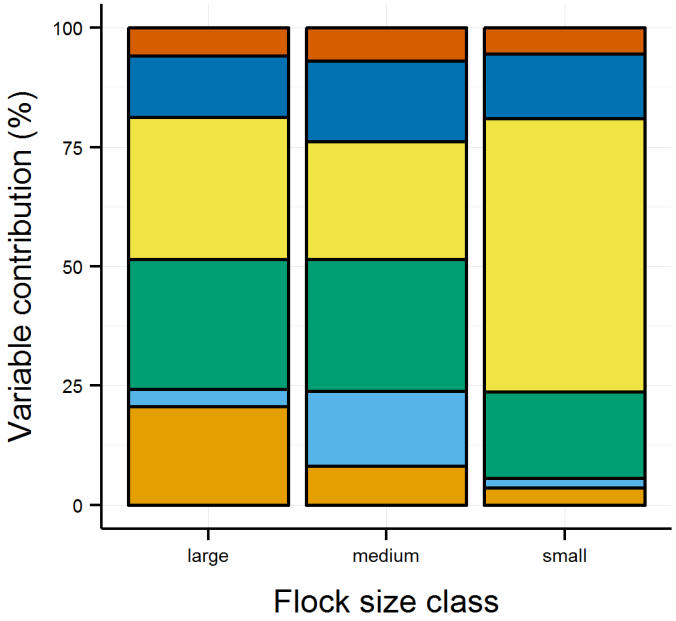

flood
forh
other
tmin
weth
wetw

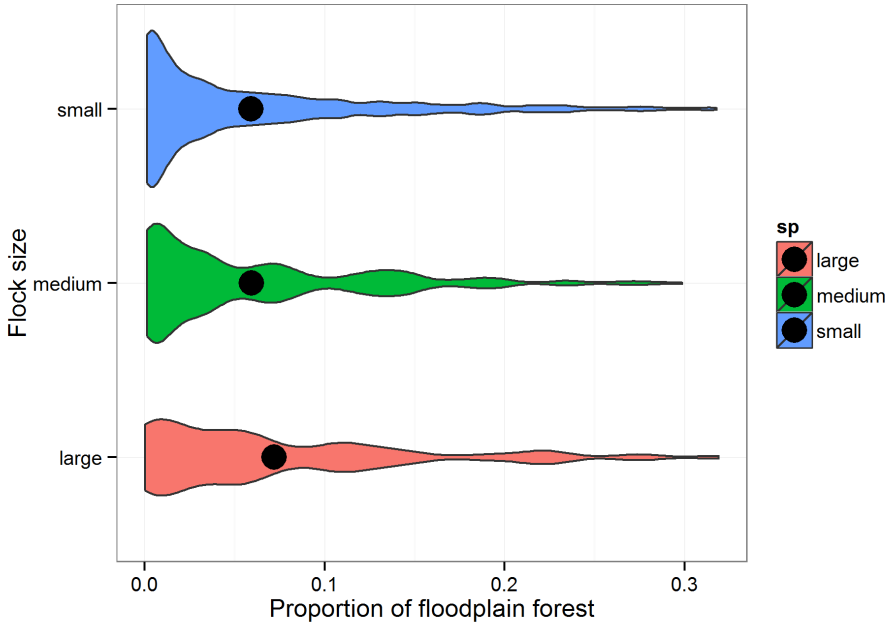

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

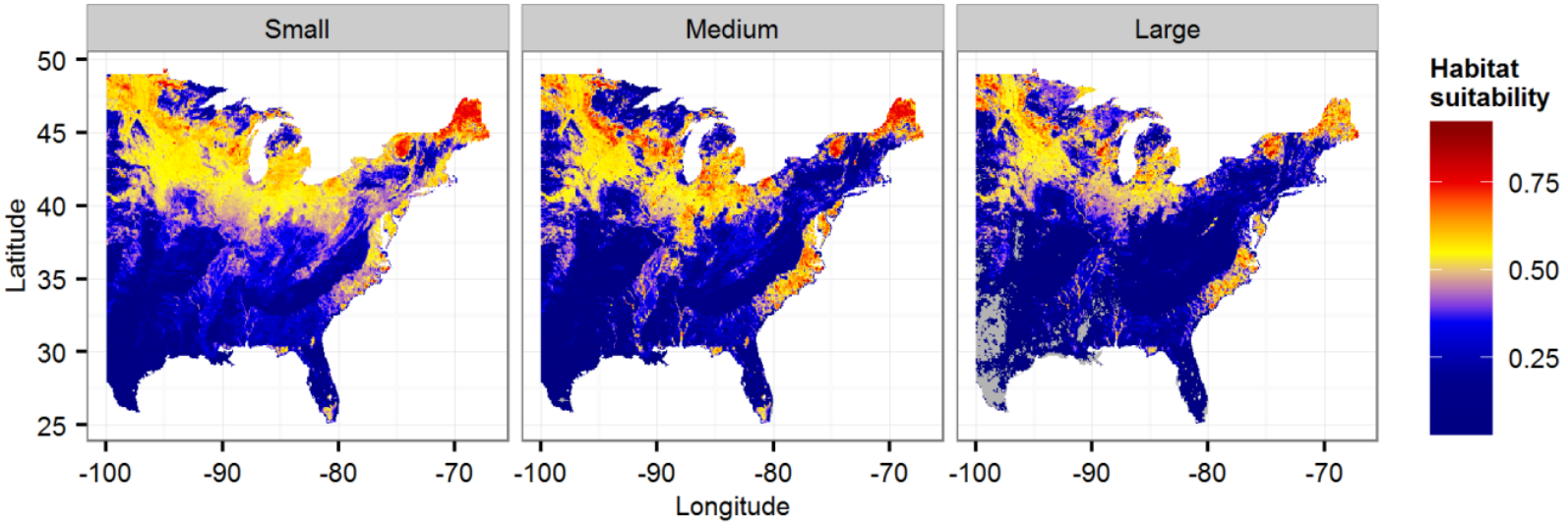

Flock size
small
medium
large
0
5
10
Average minimum temperature
sp
large
medium
small


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

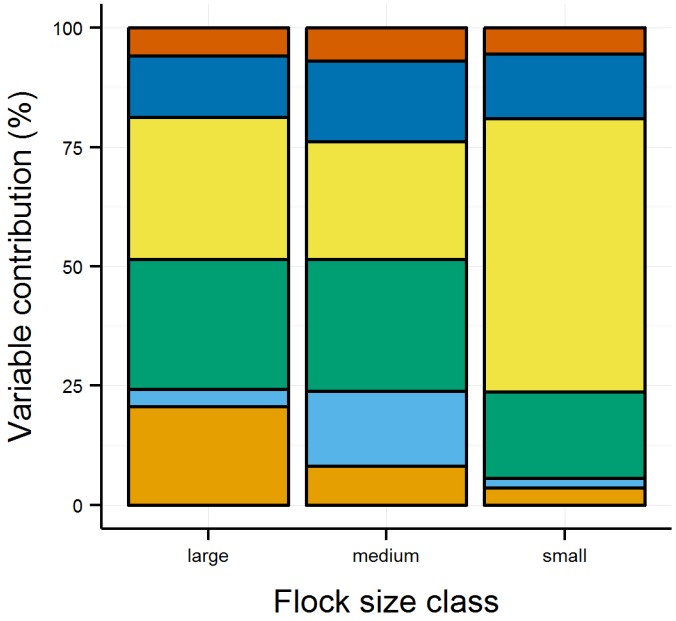

flood
forh
other
tmin
weth
wetw

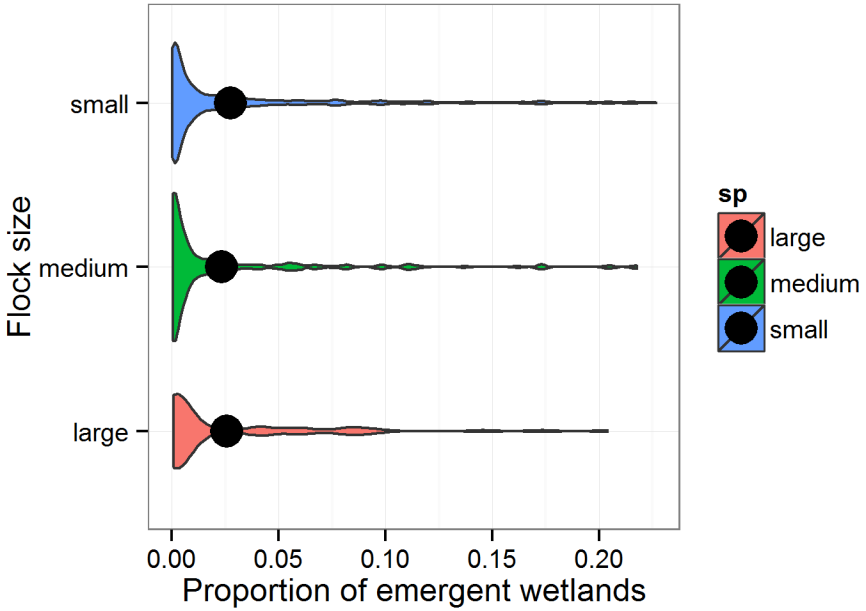

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

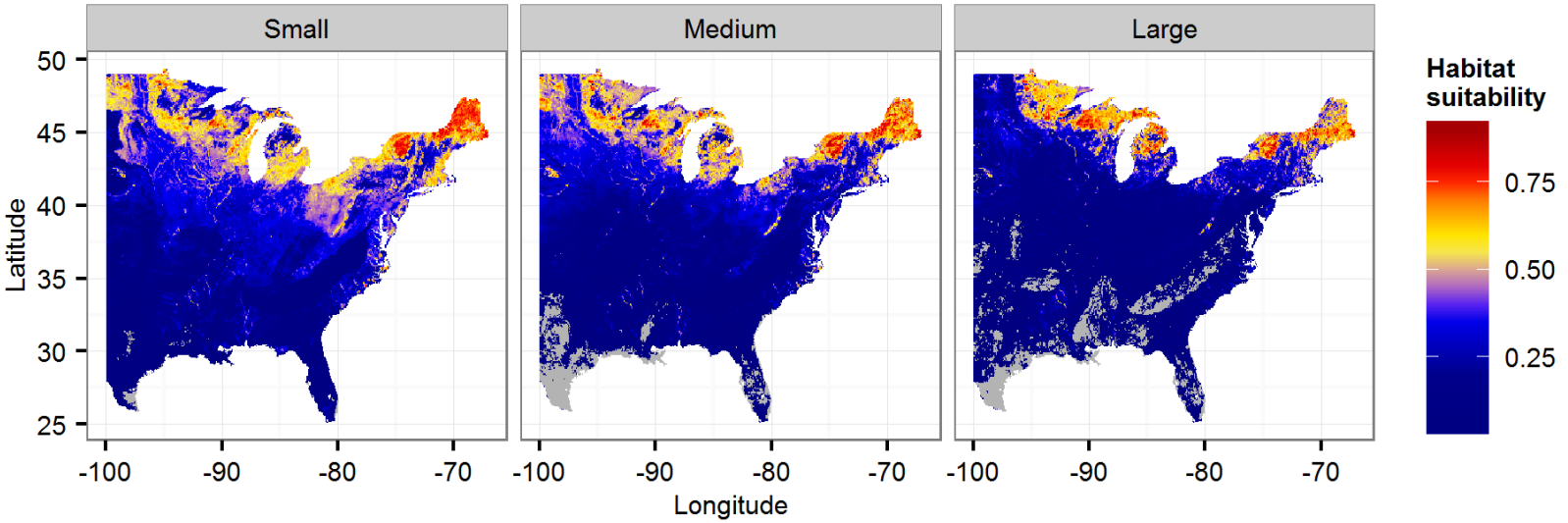

Flock size
small
medium
large
0.0
0.1
0.2
0.3
Proportion of floodplain forest
sp
large
medium
small


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

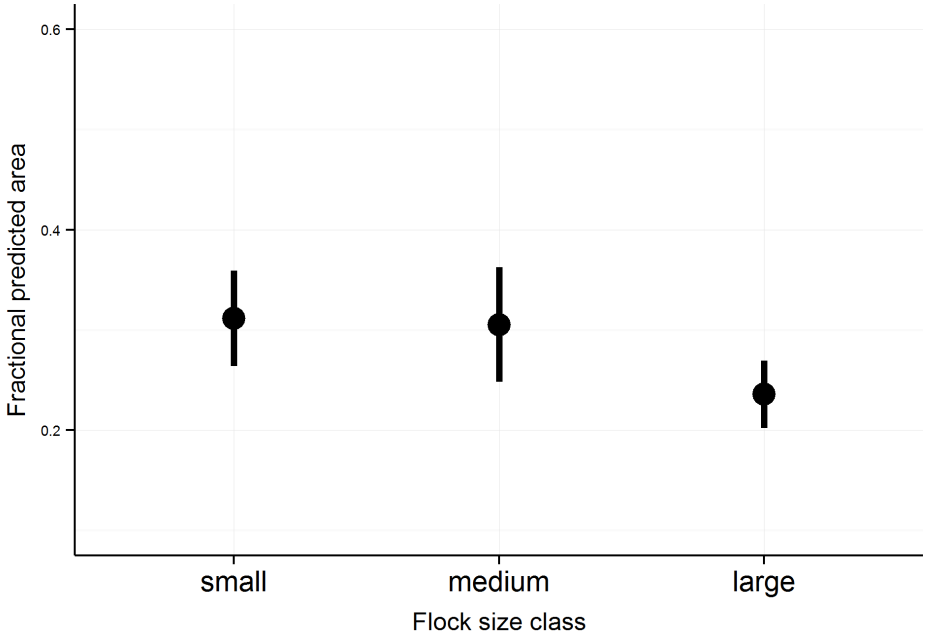

flood
forh
other
tmin
weth
wetw

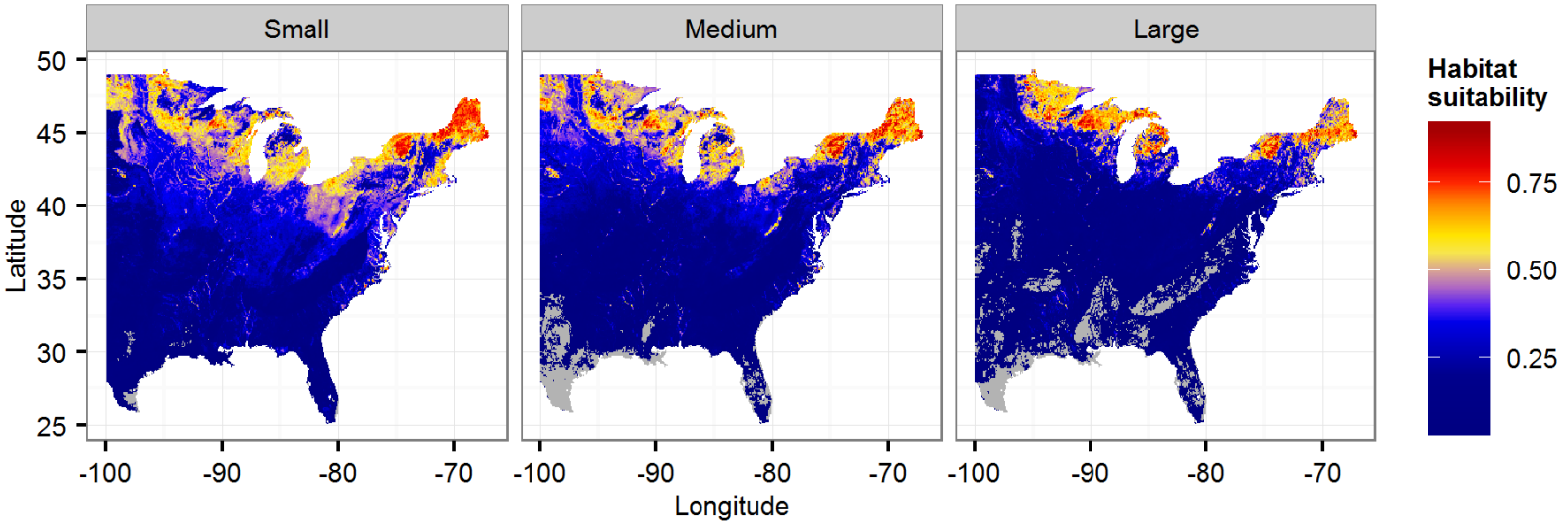

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class


Flock size
small
medium
large
0.00
0.05
0.10
0.15
0.20
Proportion of emergent wetlands
sp
large
medium
small

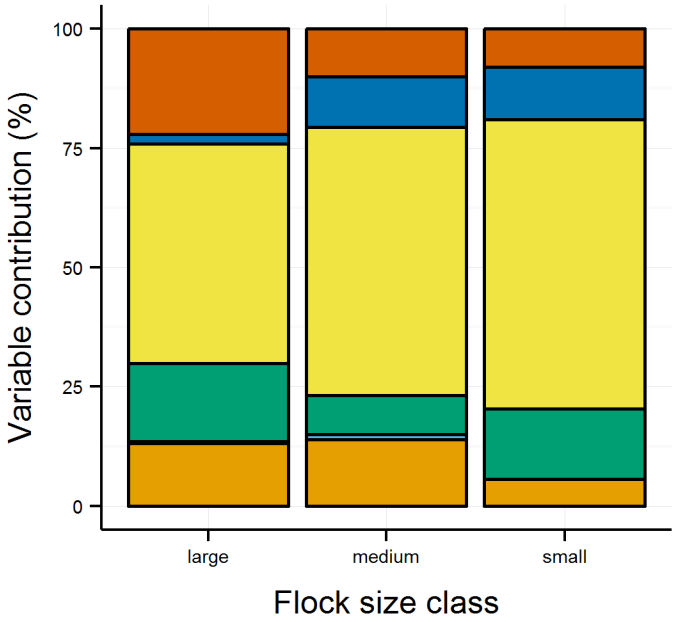


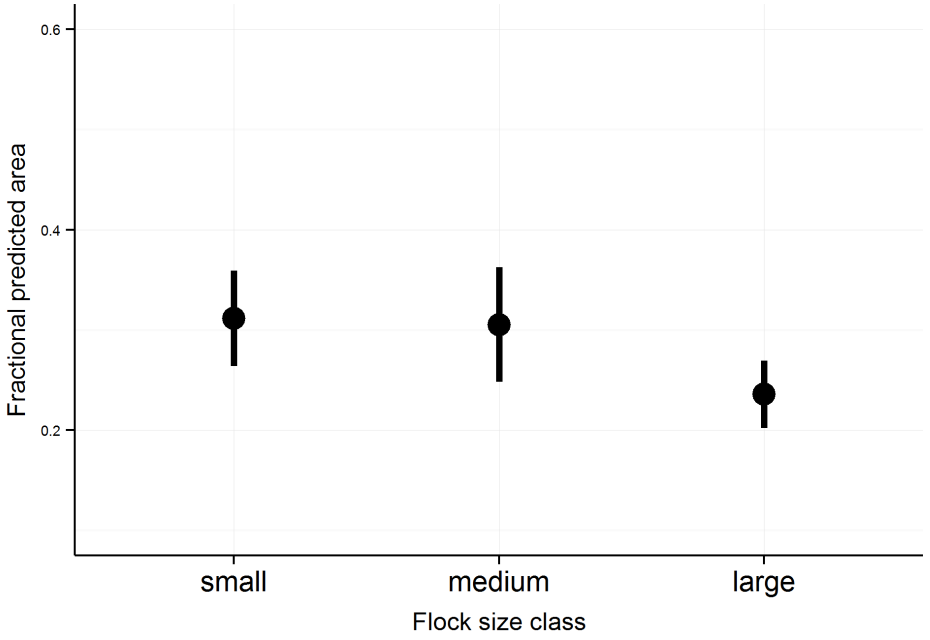
Period 5: April 23 – May 5

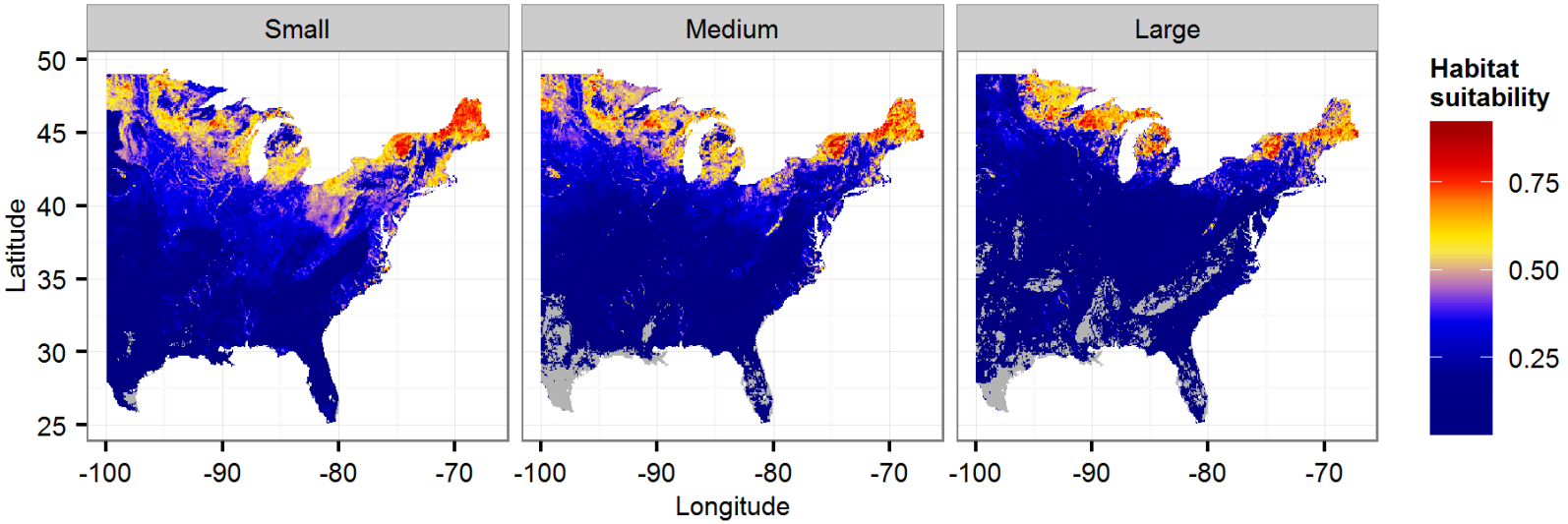



Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

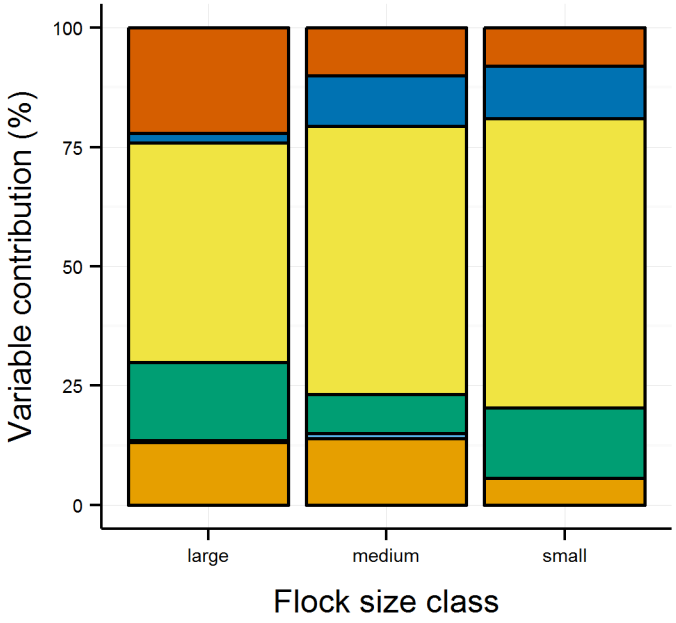

flood
forh
other
tmin
weth
wetw

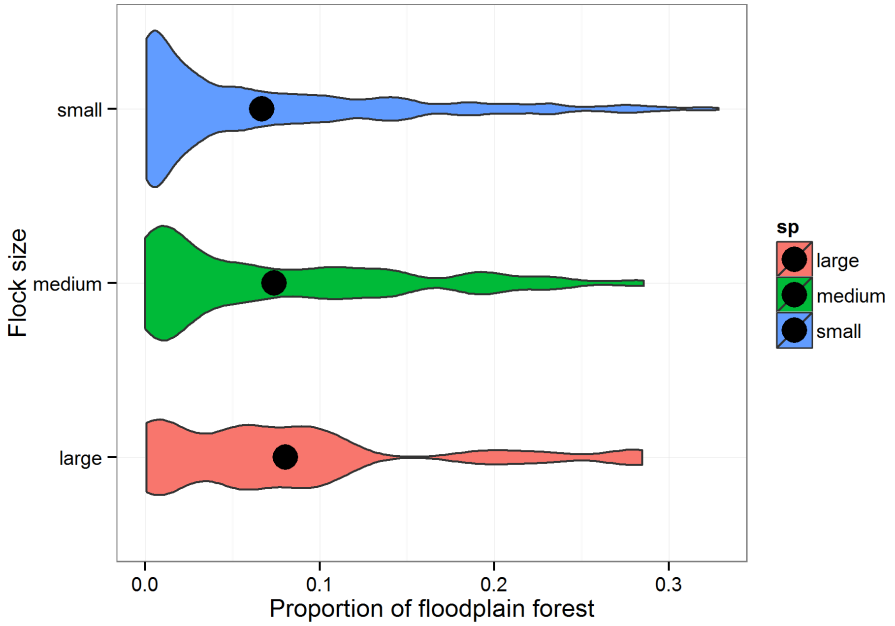

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class

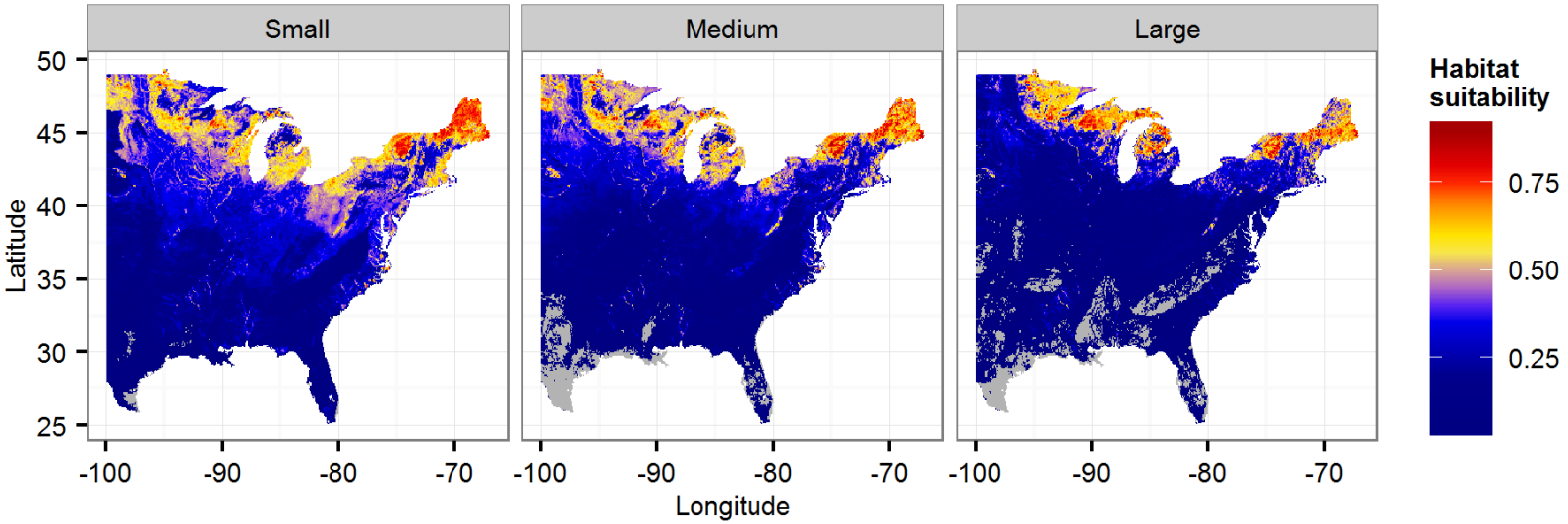

Fractional predicted area
0.6
0.4
0.2
small
medium
large
Flock size class


Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25

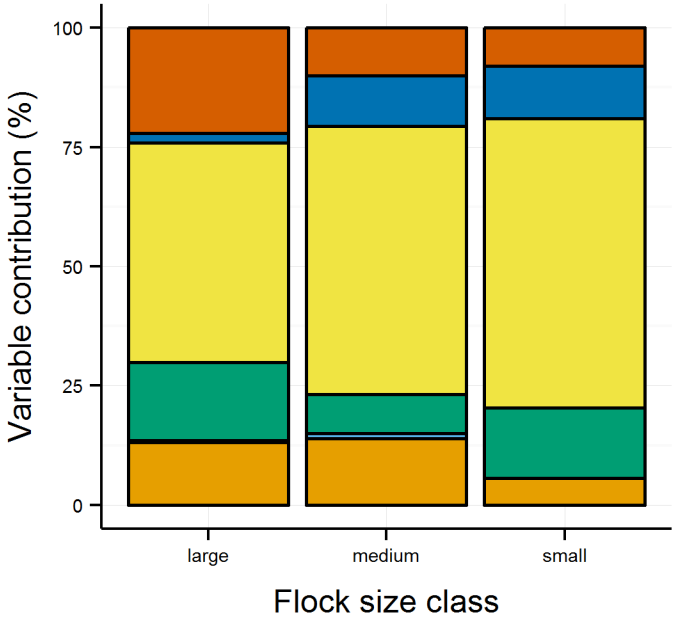

flood
forh
other
tmin
weth
wetw

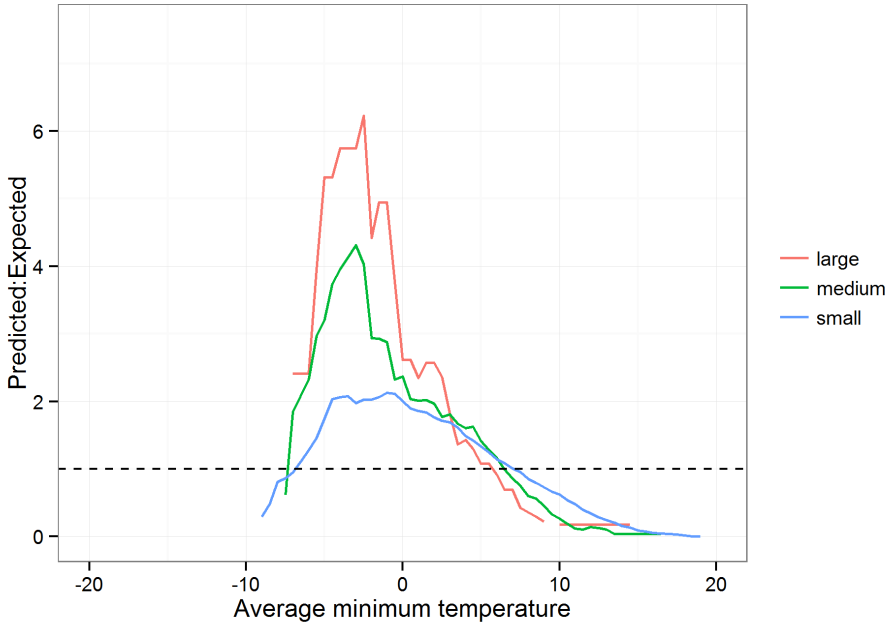

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class


Flock size
small
medium
large
0.0
0.1
0.2
0.3
Proportion of floodplain forest
sp
large
medium
small

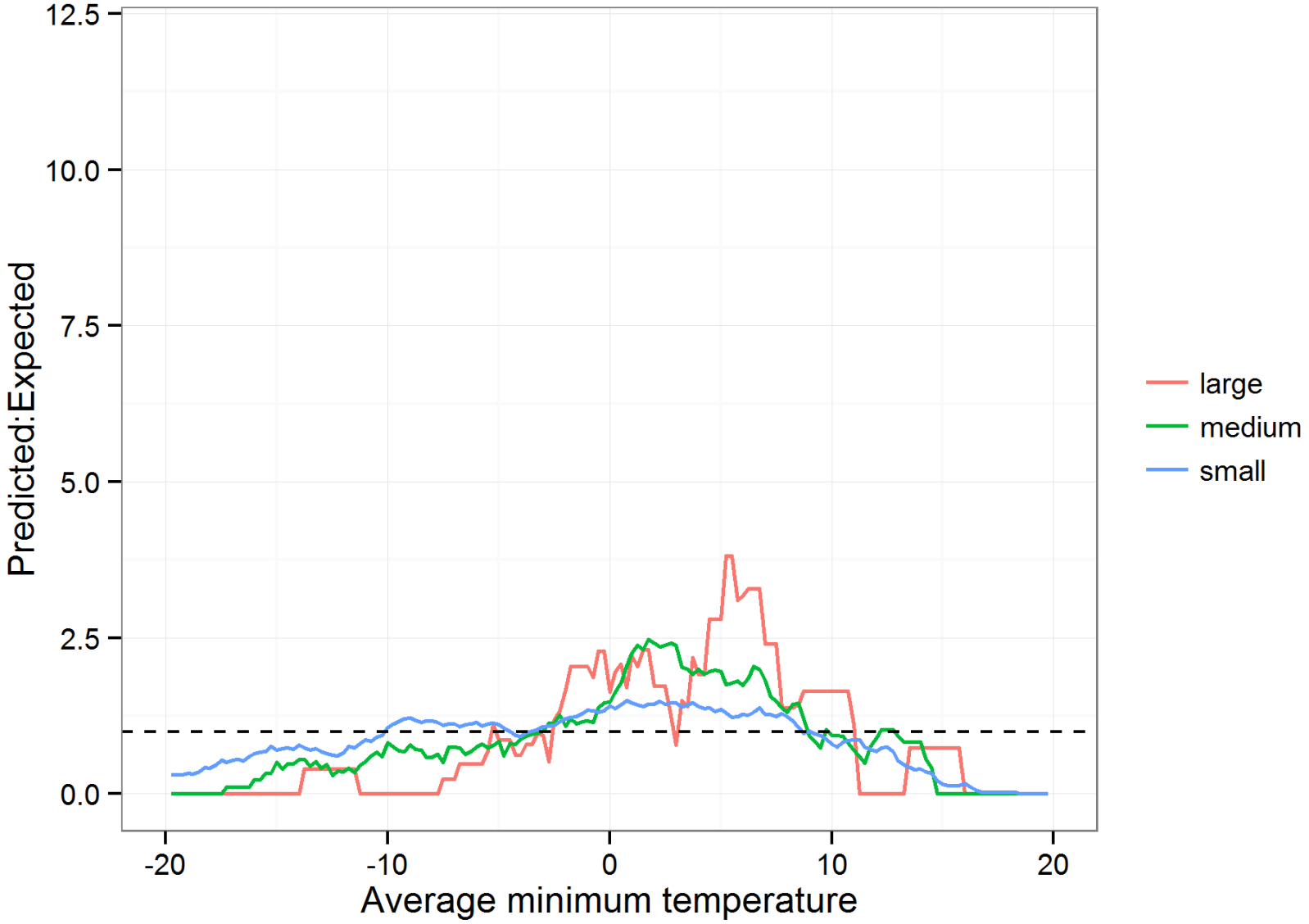

Small
Medium
Large
Latitude
Longitude
50
45
40
35
30
25
-100
-90
-80
-70
Habitat suitability
0.75
0.50
0.25


flood
forh
other
tmin
weth
wetw

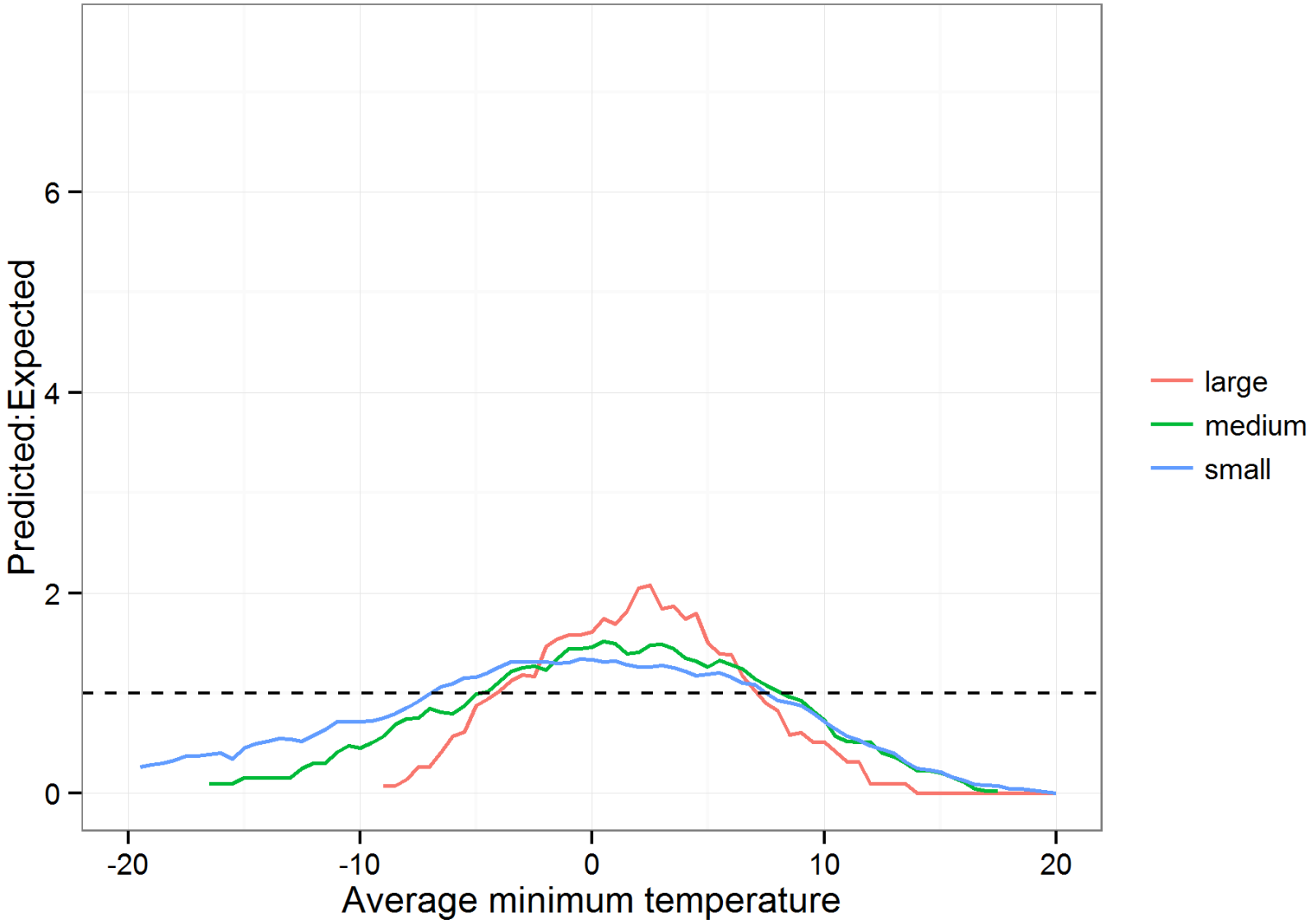

Variable contribution (%)
100
75
50
25
0
large
medium
small
Flock size class


Predicted:Expected
6
4
2
0
-20
-10
0
10
20
Average minimum temperature
large
medium
small

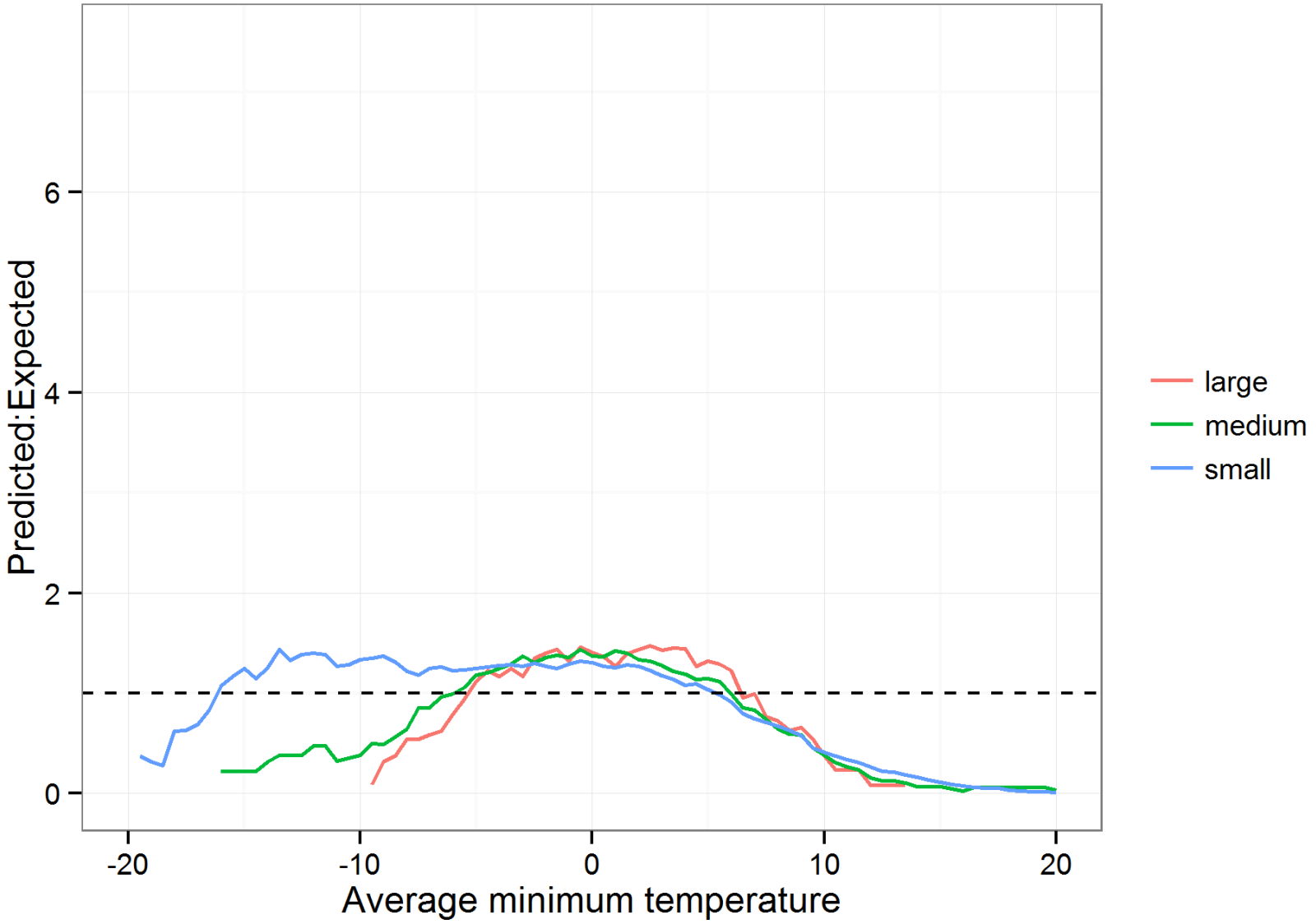
Aside: An interesting temperature relationship



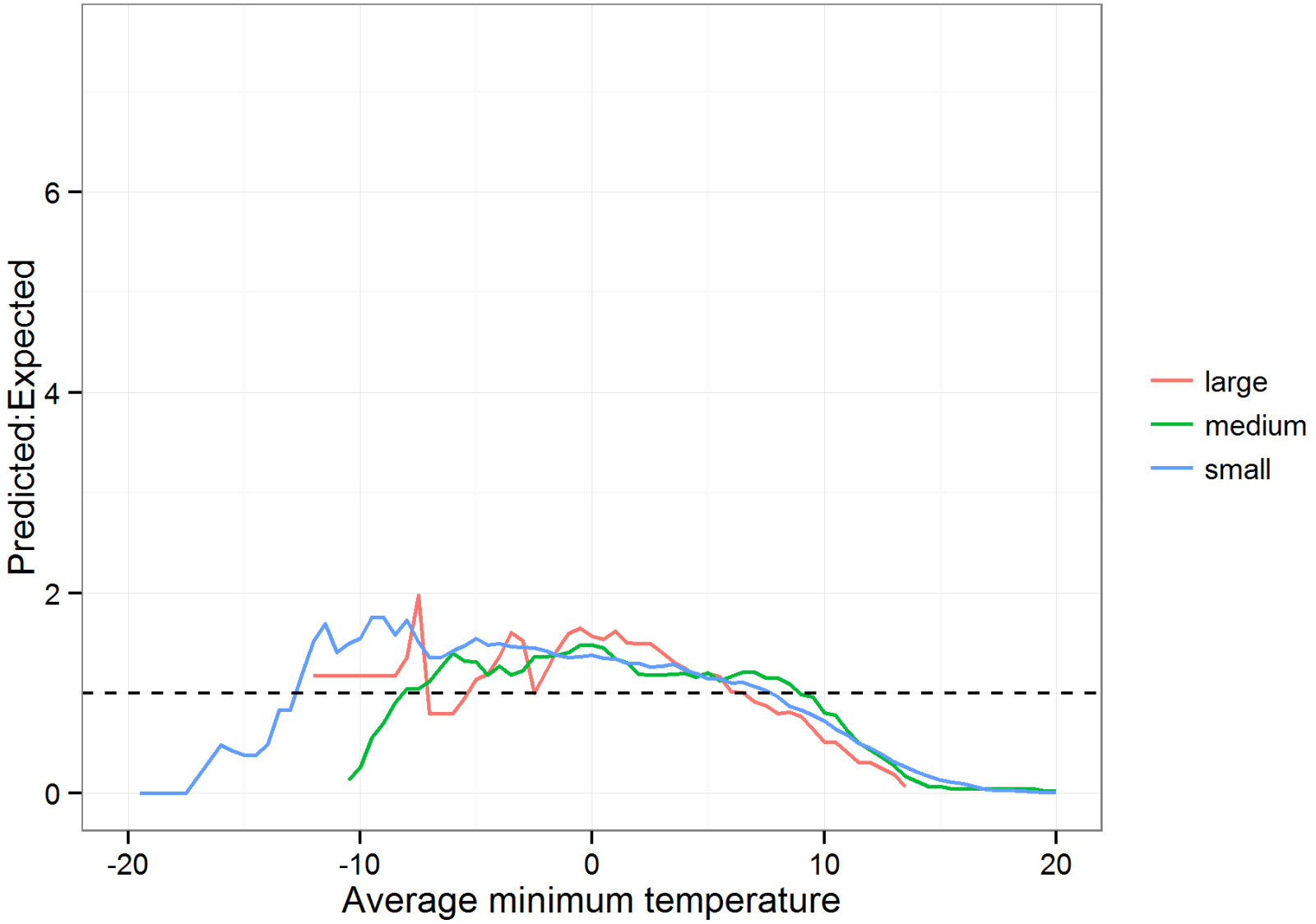
Aside: An interesting temperature relationship



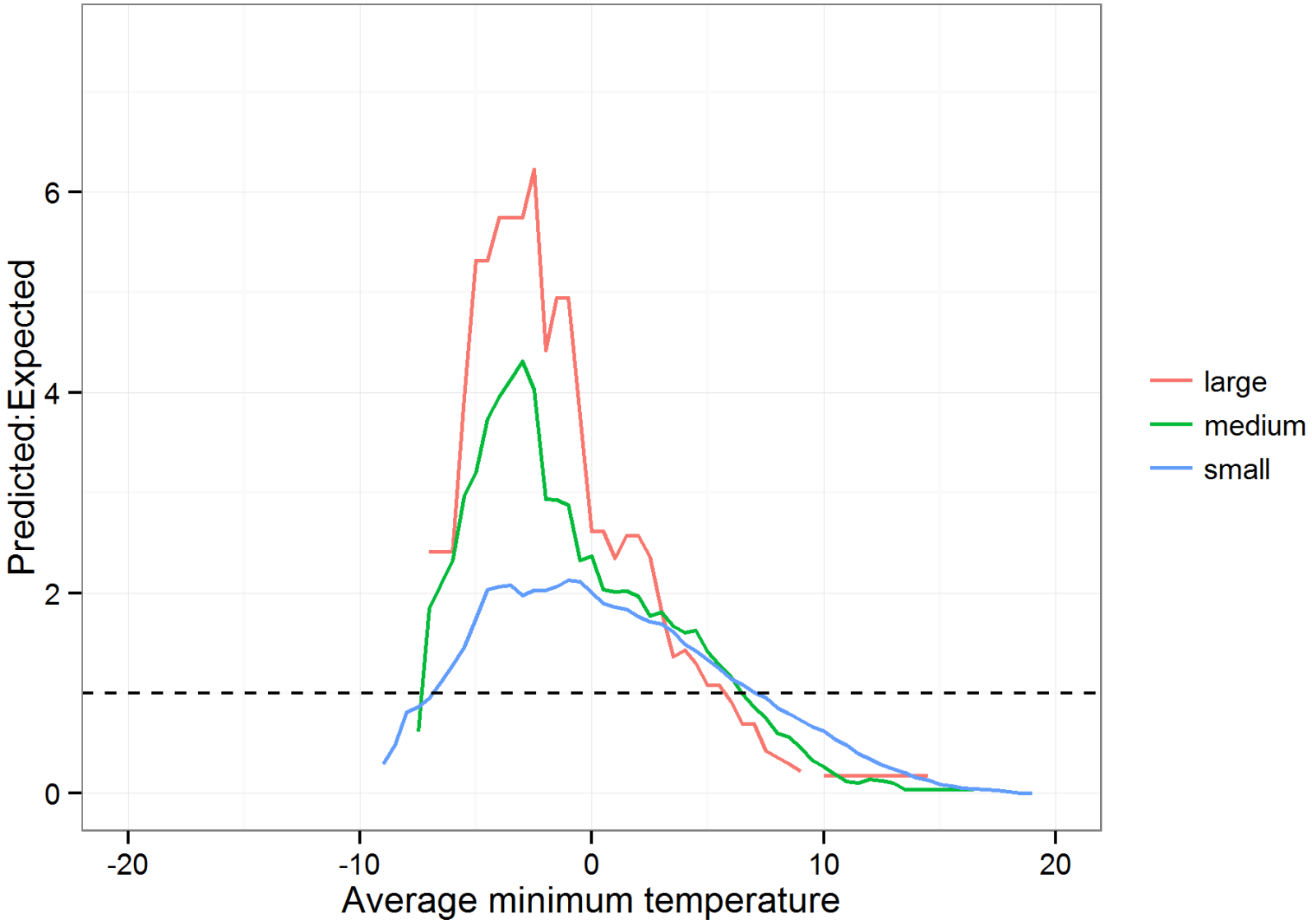
Aside: An interesting temperature relationship



Aside: An interesting temperature relationship



Aside: An interesting temperature relationship



Conclusions: Spring

1. Environmental “niche width” decreases with increasing flock size but was similar for medium and large flocks.

2. Realized ecological niches differed across flock size classes.

3. **Minimum temperature** and was most predictive of the RUBL distributions across flock size classes – importance of other wetland types!

4. For large flock and individual sightings, Blitz data improved suitability estimates.