Estimating Migration Resistance: 
a Case Study of Greenlandic Arctic Terns

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The Problem

1: How do migratory animals choose their travel routes?

2: What variables are responsible for navigation choices?

3: How can we incorporate high-quality tracking data?
Data

(Egevang 2010)
Methods

- Compare actual travel path with shortest distance path
- Measure differences in environments along both paths
Data

- Remote sensing:
  - CCMP ocean winds
  - AVHRR temperature
  - AVHRR sea ice
  - NPP layer 4 product

- Models:
  - Linear exploration
  - Circular-linear regression
  - Non-linear regression
Models

- Implemented in R

- Models:
  - Linear exploration

### Southern Migration, 9 birds, n=929

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Actual</td>
<td>-0.04</td>
<td>0.005</td>
<td>-8.09</td>
<td>&lt;0.0001</td>
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<tr>
<td>Wind Optimal</td>
<td>0.017</td>
<td>0.007</td>
<td>2.39</td>
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<tr>
<td>SST Actual</td>
<td>-0.161</td>
<td>0.02</td>
<td>-8.15</td>
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<td>SST Optimal</td>
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<td>0.02</td>
<td>7.72</td>
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<tr>
<td>NPP Actual</td>
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<td>0.087</td>
<td>-3.01</td>
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<td>NPP Optimal</td>
<td>0.234</td>
<td>0.089</td>
<td>2.64</td>
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### Northern Migration, 9 birds, n=629

<table>
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<tr>
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Future Directions

1: Finish non-linear model

2: Generalize procedure and include additional species

3: Project resistances into future climates and land-use scenarios
Acknowledgements

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