PIPING PLOVER POPULATION REGULATION ON A REBUILT BARRIER ISLAND

Jim Fraser, Jon Cohen, Larry Houghton

T & E Conservation

• Increase numbers
  – Is population regulated?
  – If so, how?
  – What determines equilibrium density?
Plover Ecology
Atlantic Coast Plover Population

- Slowly increasing since listed in 1986
- U.S. reproduction 1992-2001 = 1.34 fledglings/pair
West Hampton Dunes
Study Goals

- Piping Plovers at West Hampton Dunes N.Y.
  - Is population regulated?
  - If so, how?
  - What determines equilibrium density?
Methods

Variables Leading to Population Changes:

\[ N_{\text{year}_{t+1}} = N_{\text{year}_t} + [B - D] + [I - E] \]
### D = Mortality Rates = 1-S

<table>
<thead>
<tr>
<th></th>
<th>Adult S</th>
<th>Juv S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loegering 1992</td>
<td>0.71</td>
<td>0.41</td>
</tr>
<tr>
<td>Melvin and Gibbs 1995</td>
<td>0.74</td>
<td>0.48</td>
</tr>
<tr>
<td>Larson et al. 2000</td>
<td>0.74</td>
<td>0.32</td>
</tr>
<tr>
<td>This Study (assumed)</td>
<td>0.74</td>
<td>0.48</td>
</tr>
</tbody>
</table>

### I/E = Observed N – Expected N
Results
Density Dependent Population Changes

\[ y = -0.8137 \ln(x) - 0.2949 \]

\[ R^2 = 0.72 \]

\[ P = 0.001 \]

Density Dependent Population Changes

Density (pairs/ha)

Correlation With Density

<table>
<thead>
<tr>
<th></th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fledglings/pair</td>
<td>0.02</td>
<td>0.9</td>
</tr>
<tr>
<td>Chick Survival</td>
<td>0.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Nest Survival, Other Vital Rates</td>
<td>&gt;0.5</td>
<td></td>
</tr>
<tr>
<td>Adult/Fledgling Survival</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>
Plover Pairs at West Hampton Dunes

Immigration

Emigration

Observed

Expected

E = -0.8632x + 0.6833

R² = 0.76

P = 0.0002

Expected Density of Returning Breeders
Population Model for West Hampton Dunes, NY

- Productivity = 1.2, Imm = 0
- Productivity = 1.2, Imm = DD

Pairs observed
Emigration from WHD

<table>
<thead>
<tr>
<th>Year</th>
<th>Nesting habitat (ha)</th>
<th>% birds resighted</th>
<th>% resights breeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>43.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2001</td>
<td>36.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2002</td>
<td>33.3</td>
<td>22/26 = 85%</td>
<td>19/22 = 86%</td>
</tr>
<tr>
<td>2003</td>
<td>31.5</td>
<td>22/28 = 79%</td>
<td>14/22 = 64%</td>
</tr>
<tr>
<td>2004</td>
<td>32.0</td>
<td>18/25 = 72%</td>
<td>15/18 = 83%</td>
</tr>
</tbody>
</table>

What Determines Equilibrium Density?
Moist-Sediment Habitat (MOSH)

• Low-wave energy (mudflats, sandflats, ephemeral pools)
• Previous studies
  – Predicts presence of breeding plovers
  – More food
  – Higher chick foraging rates
  – Faster chick growth (small sample)
  – Higher chick survival (sometimes)

Average Density 2001-2004

<table>
<thead>
<tr>
<th>Area</th>
<th>Pairs/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD</td>
<td>0.87 ± 0.11</td>
</tr>
<tr>
<td>Adjacent Area</td>
<td>0.53 ± 0.07</td>
</tr>
</tbody>
</table>
Piping Plover Density, NY and Monomoy, MA 2001-2003

\[ y = 0.3844x + 0.4926 \]

\[ R^2 = 0.69 \]

Piping Plover Density, West Hampton Dunes, N.Y. 2001

\[ R^2 = 0.80 \]

\[ p < 0.0001 \]
Main Points

– Population regulated by immigration and emigration (Might be different if nearby populations were at equilibrium density)

– Habitat quality (food supply) determines density within a given area of nesting habitat

– Territorial behavior limits density

Conservation Implications:
Can increase local density
Regionally, reproduction must be > 1.3 Chicks/pair

Thanks to:
New York District,
U.S. Army Corps of Engineers
Thanks to:

- National Park Service
- New York DEC
- U. S. Fish and Wildlife Service
- U.S.G.S. Biological Resources Division
- New York State Parks
- New York County Parks
- The Nature Conservancy
- Town of Southampton, NY
- Village of West Hampton Dunes
- Village of Westhampton Beach, NY
Plover Pairs at West Hampton Dunes

- Observed
- Expected

**Immigration**

**Emigration**

Years: 1992 to 2005