Wildlife ‘hotspots’ in the California Current

Marine Spatial Planning

A National and International Priority

- Support sustainable uses
- Provide for the public
- Promote compatible uses
- Decrease governance conflicts

“depends on sound scientific information”

“it seeks to balance economic development and environmental conservation, and not focus only on the goals of conservation or protection”
Develop a methodology for identifying marine ‘hotspots’

Apply this to the California Current System

Provide results to inform marine spatial planning
Marine birds aggregate to forage in predictable areas determined by bathymetric and oceanographic features.
Seabird data coverage

- NMFS RF (1997 – 2006) 10yr
- CalCOFI (1997 – 2006) 10yr
- ORCAWALE (2005 – 2008) 2yr
- NMFS SR (2006 – 2008) 2yr

Lots of data

Uneven coverage

WA, OR and NorCA
Variables included during modeling

**Static: Bathymetric**

- Depth (minimum)
- Depth (average)
- Contour Index (Roughness)
- Dist 200-m isobath (shelf break)
- Dist 1-km isobath (shelf slope)
- Dist 3-km isobath (deep ocean)

**Static: Location**

- Distance to nearest land
- Latitude
Model development

- Modeled seabird abundance based on habitat features
- We used Bagged Decision Trees for statistical analysis (advanced data mining technique used to discover patterns in data)
- Adjusted for temporal variation (within year, between years)
- Controlled for Pacific basin scale ocean conditions
- We modeled 16 bird species in relation to 20 variables
- We analyzed number of foraging individuals per “bin”
- Used models to make predictions about the entire California Current (4 x 4 km resolution)
Observed data
(all cruises, all seasons, all years)

Density
- Low (>0 - 5 / km²)
- Med (>5 - 20 / km²)
- High (>20 / km²)

No Birds Observed

Depth Contour
- 200 m
- 1000 m
- 2000 m
Observations VS Predictions – Cassin’s Auklet

Observed data
(all cruises, all seasons, all years)

Predictions
in May

Density
- Low (>0 - 5 / km²)
- Med (>5 - 20 / km²)
- High (>20 / km²)

No Birds Observed

Depth Contour
- 200 m
- 1000 m
- 2000 m

Predicted Average Abundance
- >1
- >0.75 - 1
- >0.5 - 0.75
- >0.3 - 0.5
- >0.2 - 0.3
- >0.1 - 0.2
- 0 - 0.1

200m isobath
# Model results – Location, Location, Location!

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<thead>
<tr>
<th>Variables</th>
<th>BFAL</th>
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### Legend
- **Red** - High
- **Yellow** - Medium
- **Light Yellow** - Low
How did we use all these models?

- **Abundance**: summed standardized abundance of all species (each spp contributes equally to product)

- **Importance**: smallest set of cells that constituted 25% of the species’ top total abundance.

- **Persistence**: number of years that a cell was in the top 5% of predicted abundance for a particular species.

These were calculated on a seasonal basis and averaged across all seasons.
Hotspots – ABUNDANCE

Winter

Summed Standardized Abundance
- >480
- >360 - 480
- >230 - 360
- >160 - 230
- >100 - 160
- >60 - 100
- <=60

NMS Boundary
200m isobath
Hotspots – IMPORTANCE

Winter

Spring
Hotspots – PERSISTENCE (top 5%)
• Bathymetric (underwater topography) variables were more important in predicting ‘hotspots’.

• ‘Hotspots’ often aligned well with current protected areas (e.g., National Marine Sanctuaries).

• ‘Conservation gap’ with important ‘hotspots’ from Heceta Bank to Cape Mendocino.
Conservation status

To assess the conservation status of important seabird foraging habitats.

73%
### Fishing restrictions

<table>
<thead>
<tr>
<th>Fishing Restrictions</th>
<th>Number of MPAs with Hotspot</th>
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<td>Commercial and Recreational Fishing Prohibited</td>
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<tr>
<td>Commercial and Recreational Fishing Restricted</td>
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<td>Restrictions Unknown</td>
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56% have specific fishing restrictions
Next Step:
Threats assessment – California

Identify threats to further prioritize hotspots off California
Next Step: Threats assessment – U.S. West Coast

Halpern et al. 2009 from National Center for Ecological Analysis and Synthesis
Next Step:
Downscaling models to inform management

Develop predictive models that focus on specific areas.

Information is important to support local management:

1. Heceta Bank
2. Klamath and Eel river
3. Northern Vancouver Is.
Acknowledgements

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Thank you!