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Using seabirds and habitat features to identify 'hotspots' in the California Current

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and many collaborators

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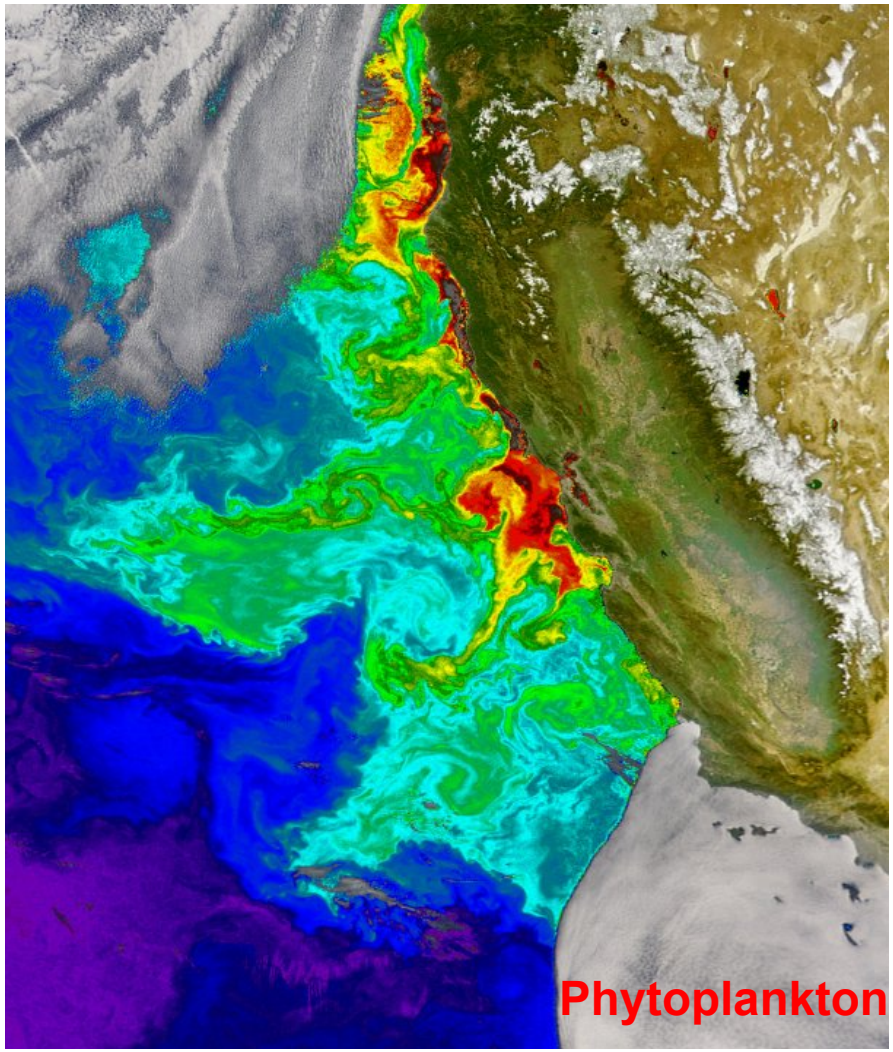
Support MPAs in federal waters

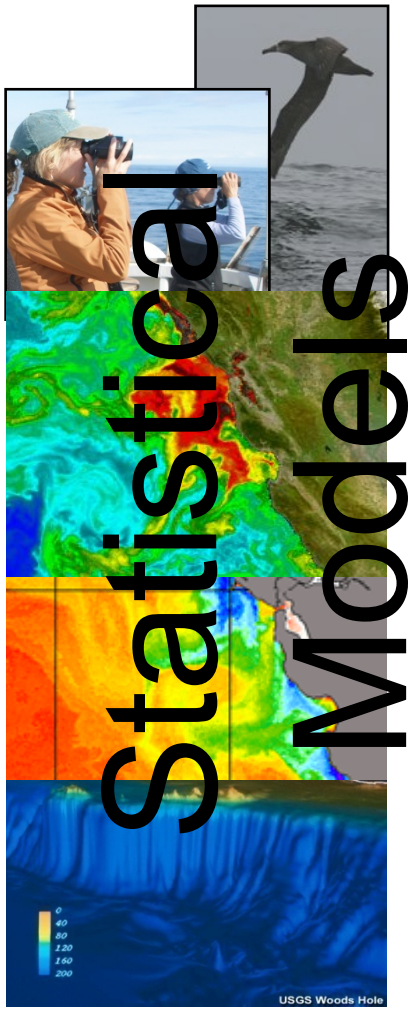
- Identify marine ‘hotspots’ in California Current System
- Use results to inform marine spatial planning in the U.S. West Coast.

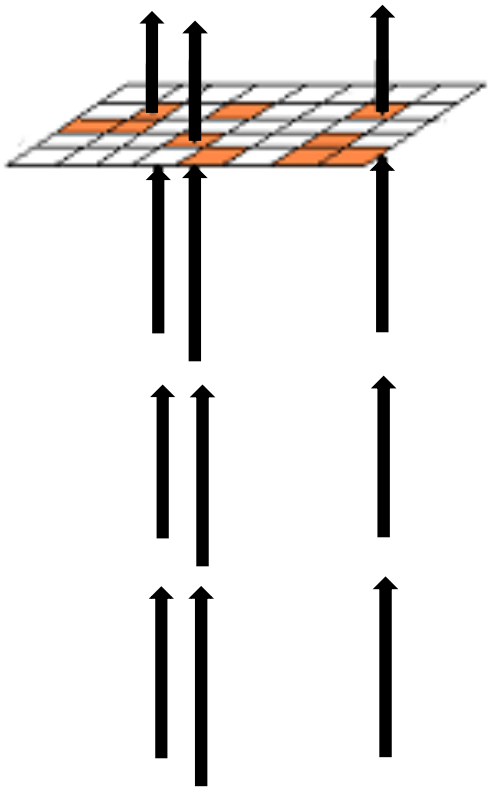


Hypothesis

Marine birds aggregate to forage in predictable areas determined by bathymetric and oceanographic features

How did we accomplish this work?



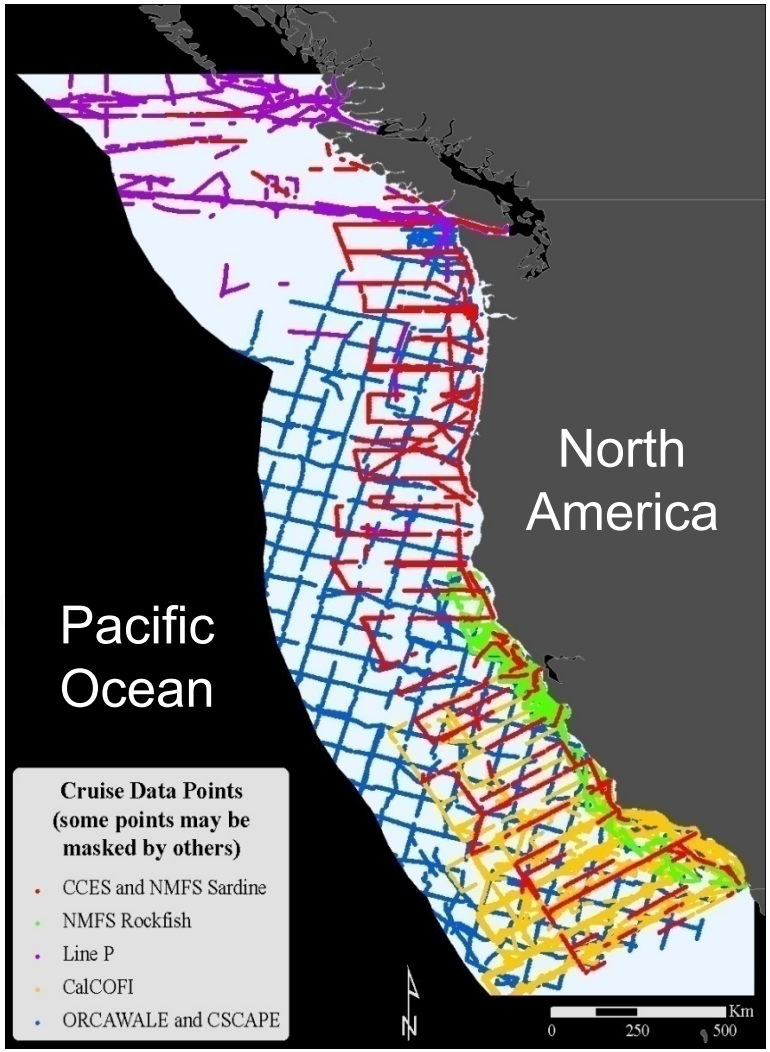


Top Predators

Seabird data coverage

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

Lots of data
Uneven coverage
WA, OR and NorCA



Variables included during modeling

Bathymetric

- Depth (minimum)
- Depth (average)
- Contour Index

- Dist 200-m isobath
- Dist 1-km isobath
- Dist 3-km isobath
- Dist nearest land

Other

- Year
- Julian date
- Latitude

Model development

- Modeled seabird abundance based on habitat features determined by bathymetry or oceanography.
- We used Bagged Decision Trees for statistical analysis (advanced data mining technique used to discover patterns in data)
- We controlled for spatial and temporal differences in the onset of upwelling.
- We controlled for Pacific basin scale oceanographic conditions.
- We modeled a total of 16 birds (2 of conservation concern)

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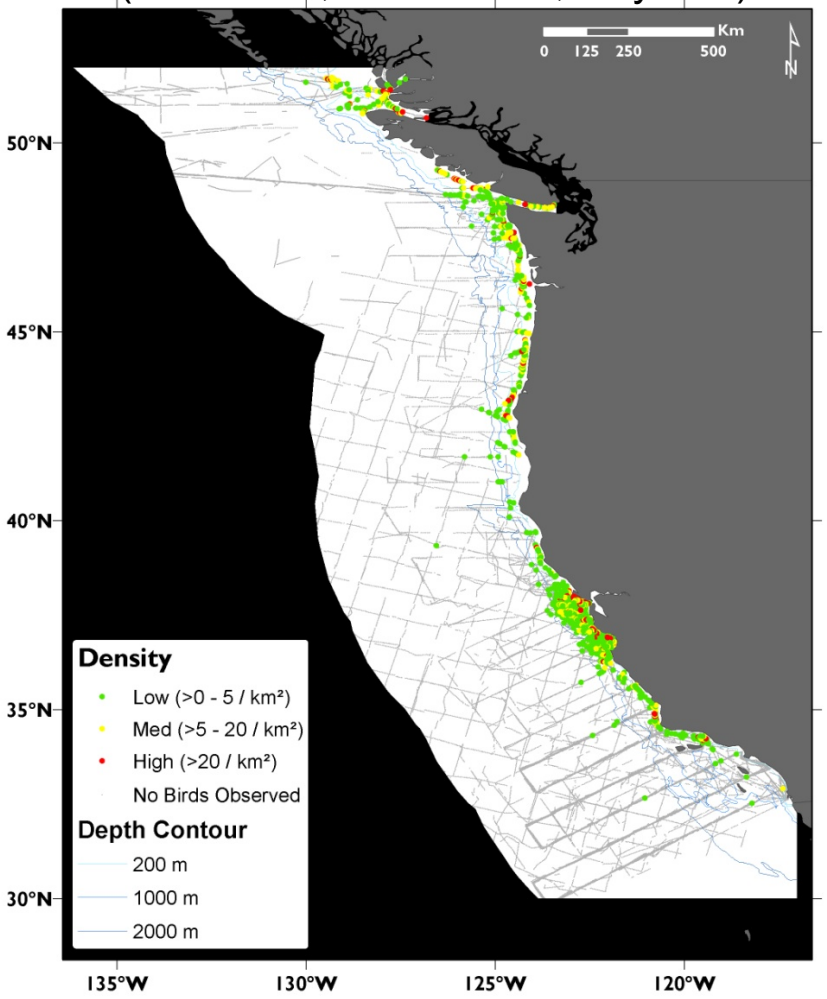
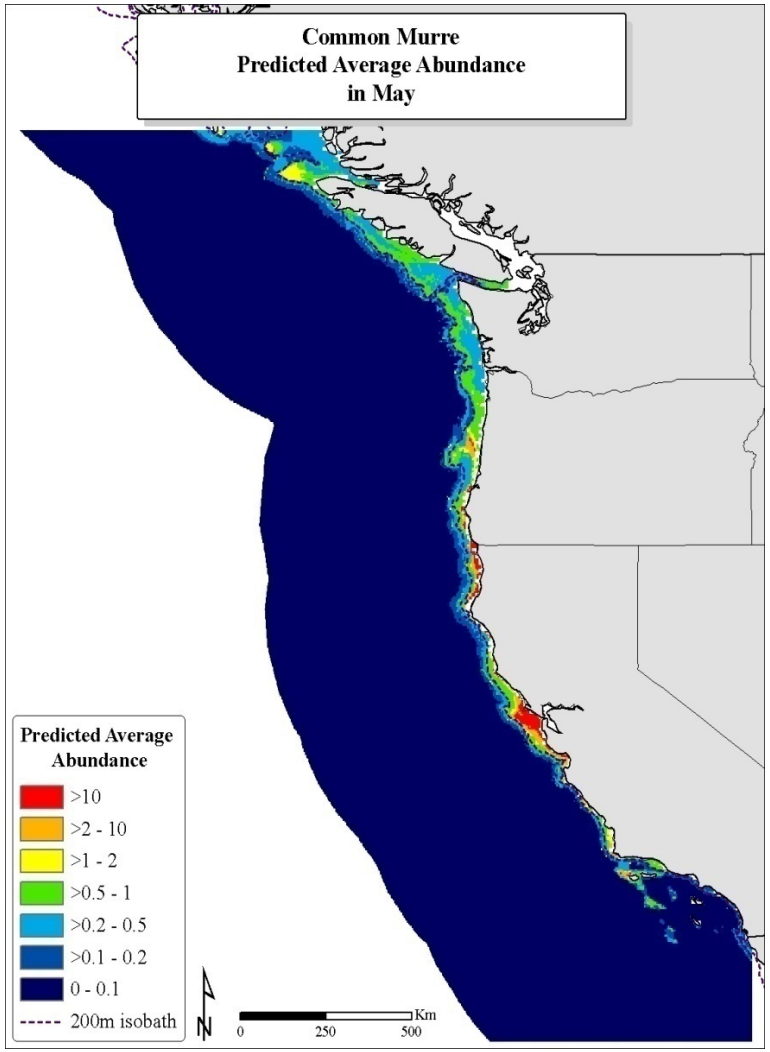
Observations VS Predictions – Common Murre

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





Common Murre - Oct 97 to Oct 08

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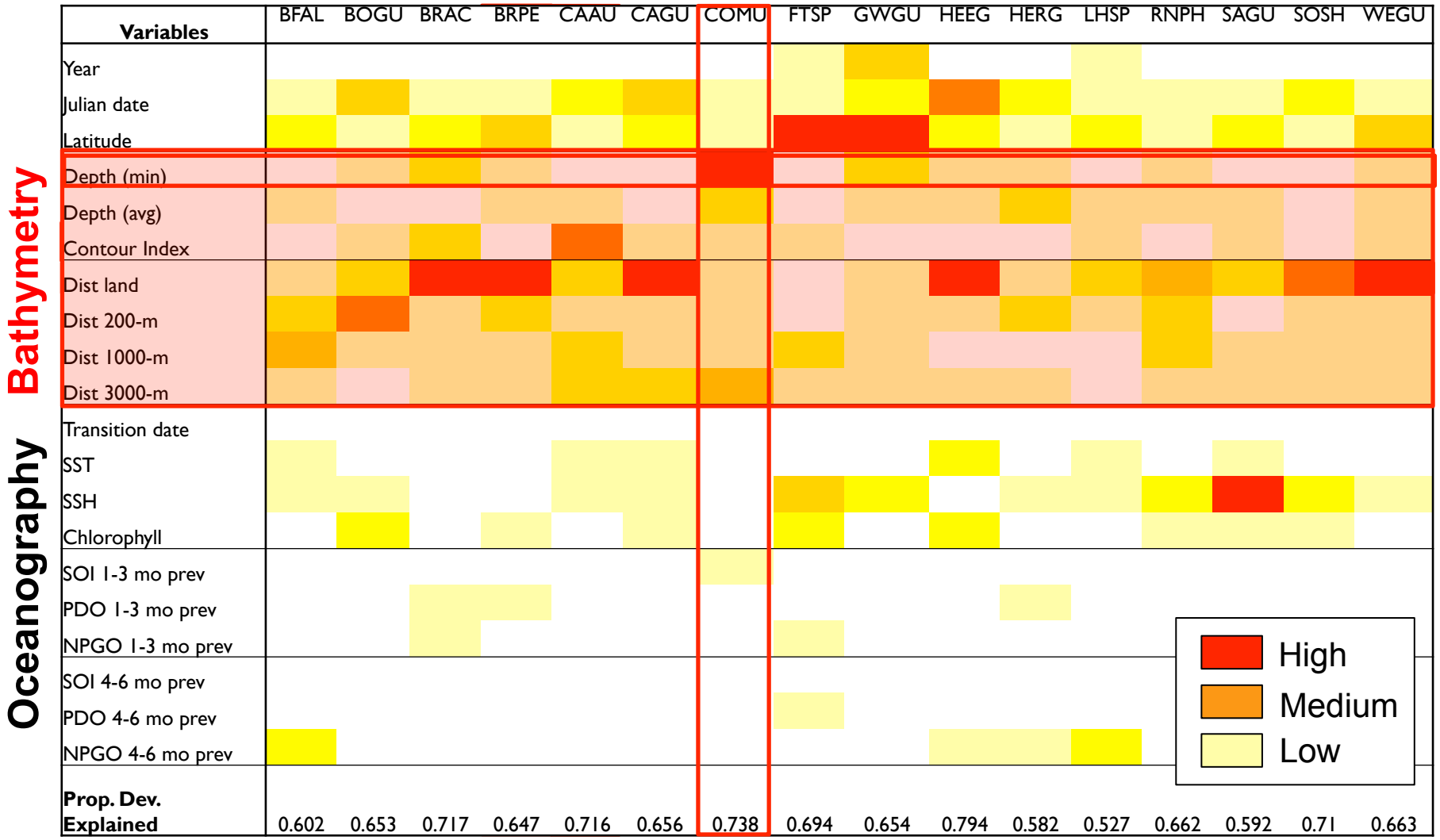
Model results – Location is most important



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.

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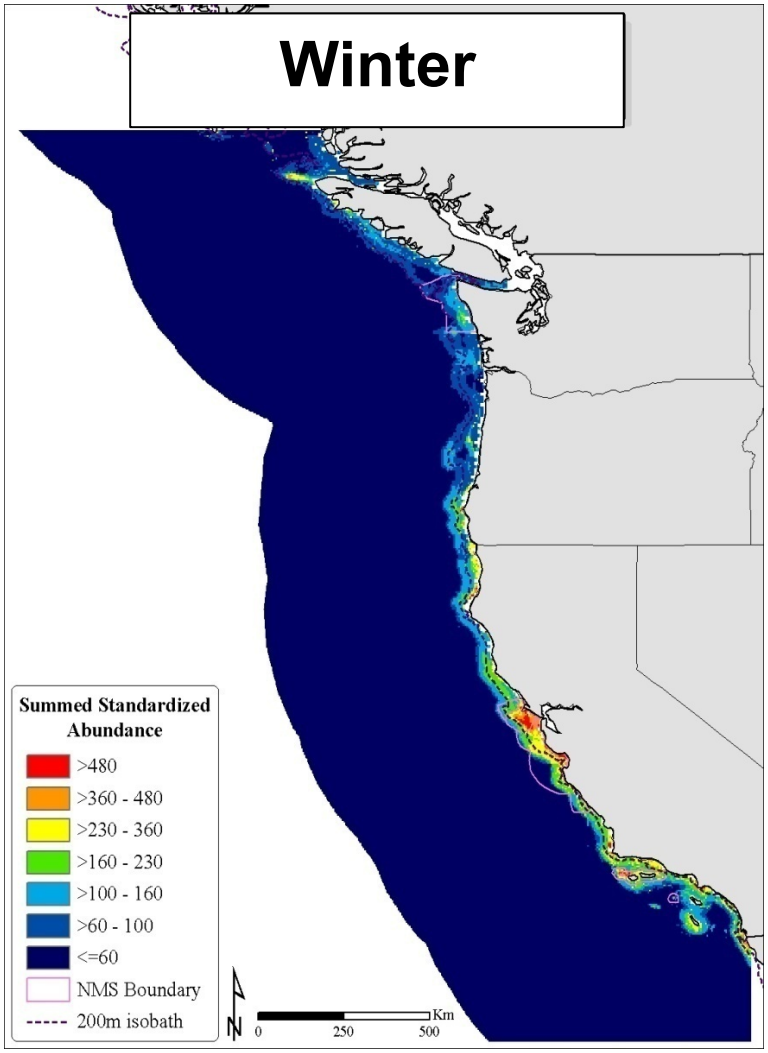
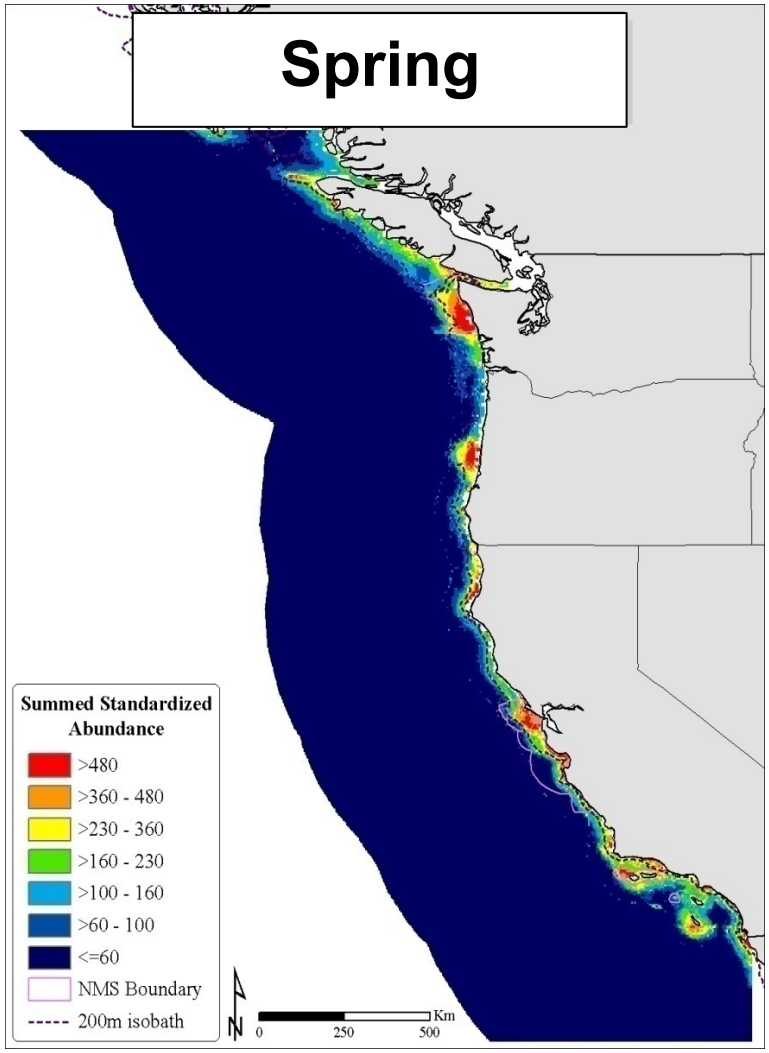
Hotspots – ABUNDANCE





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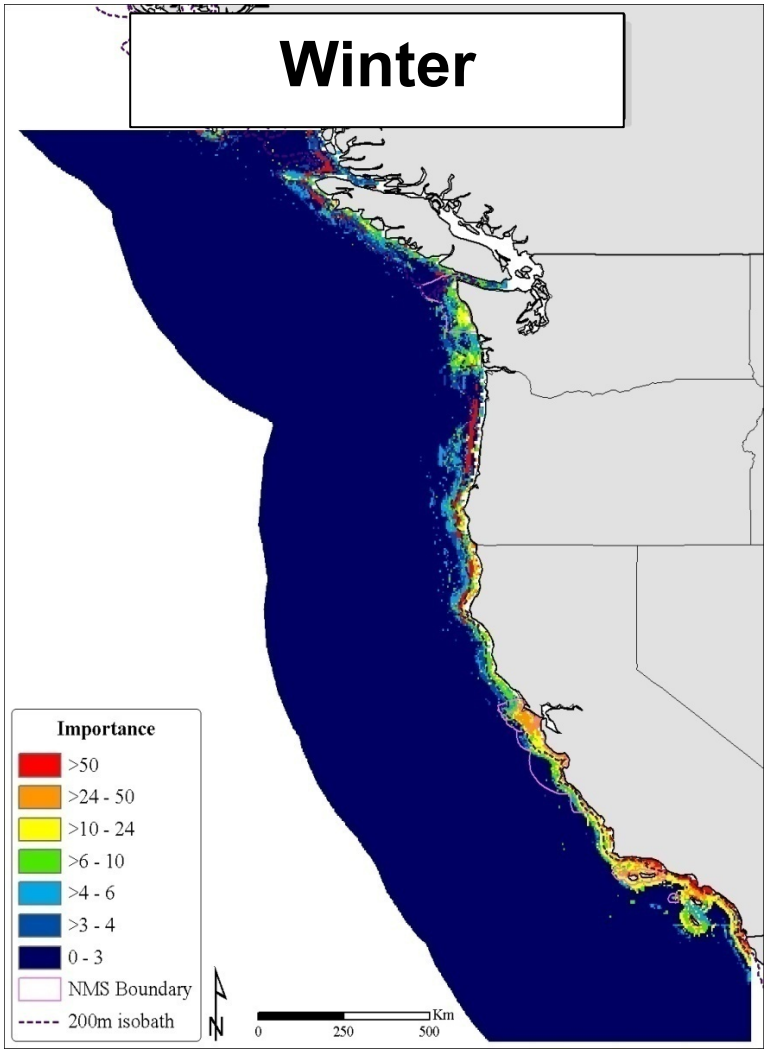
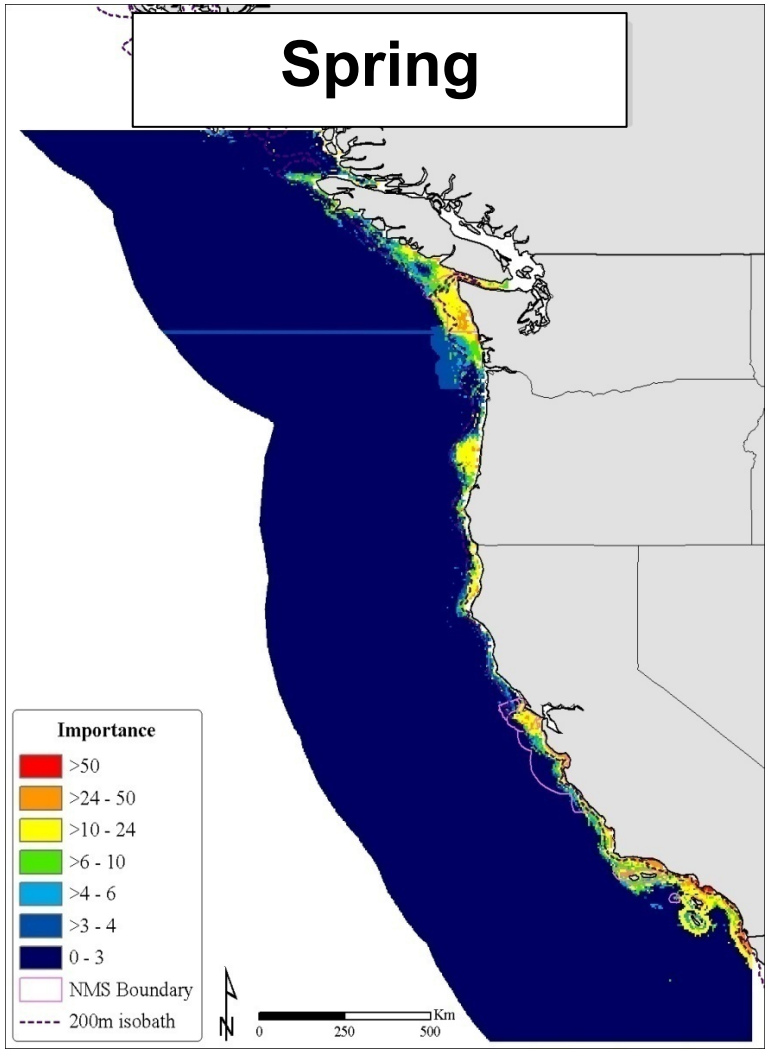
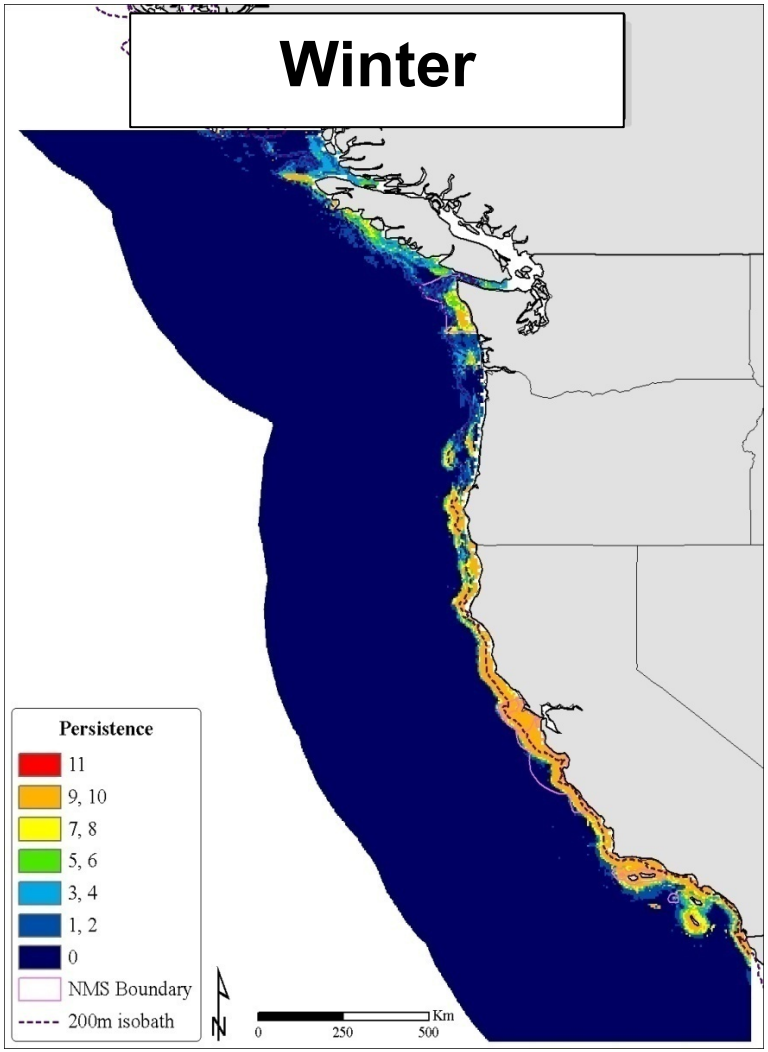
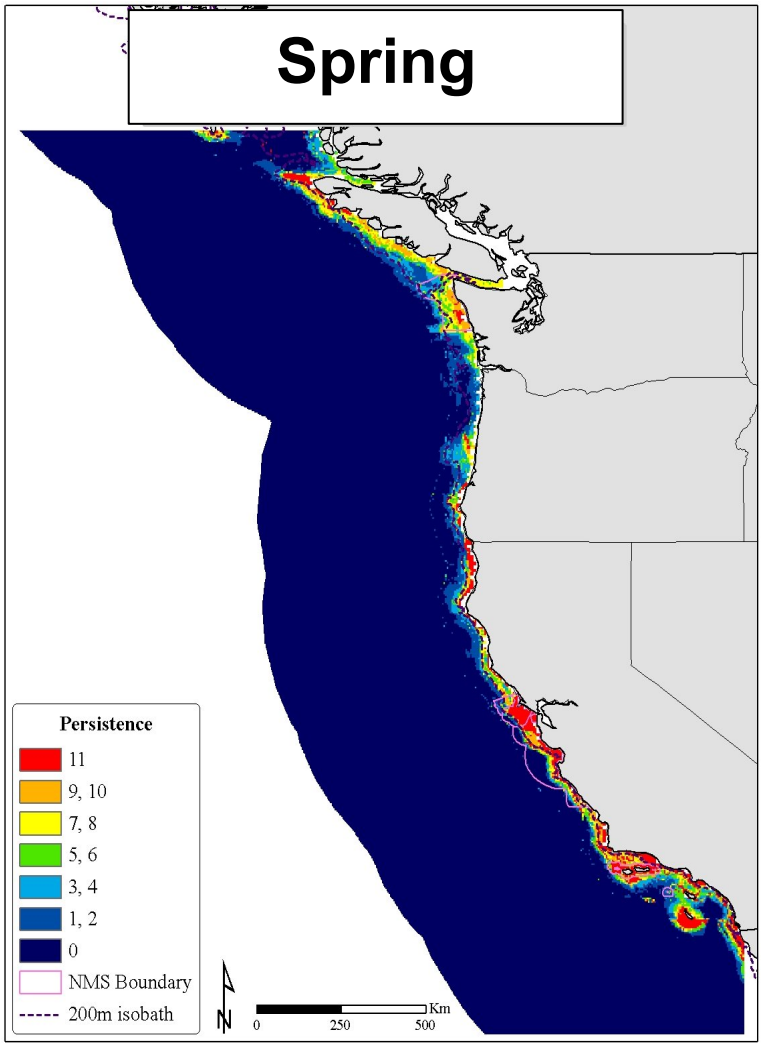
Hotspots – IMPORTANCE



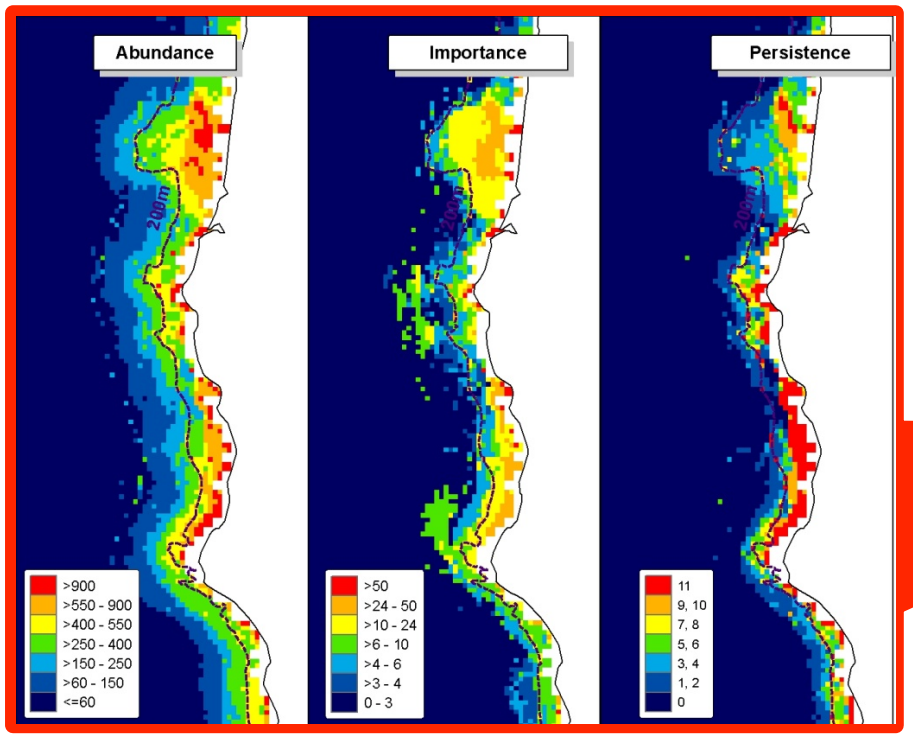


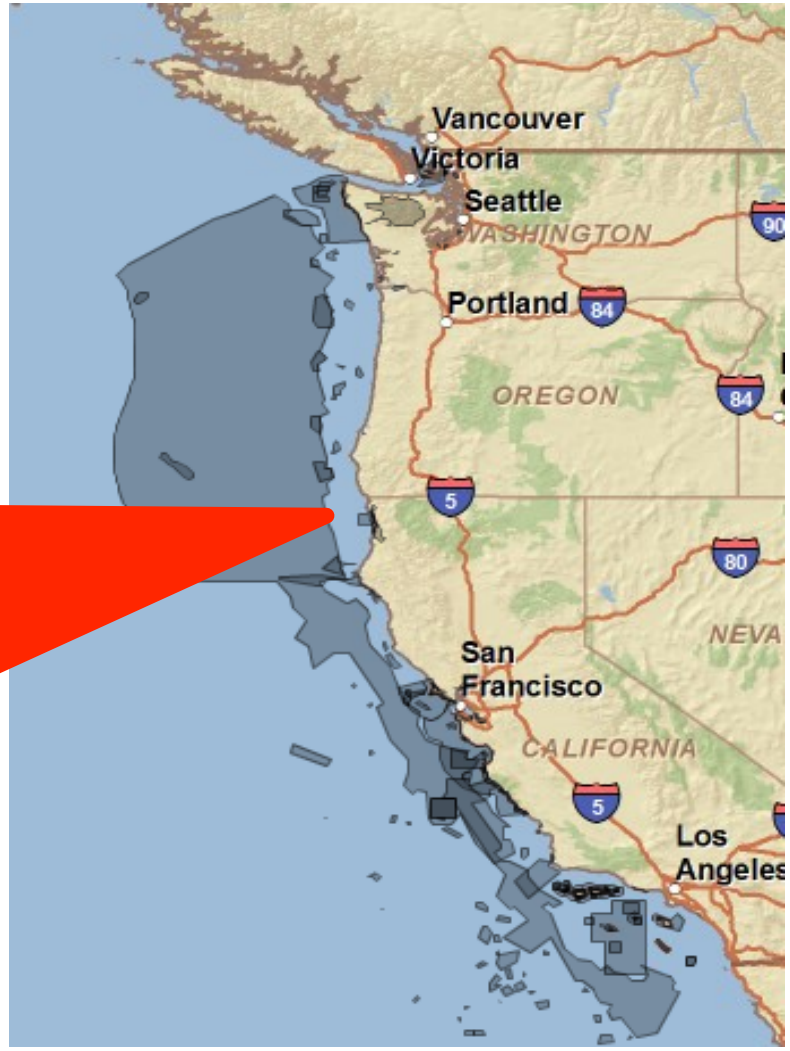
Hotspots – PERSISTENCE (top 5%)





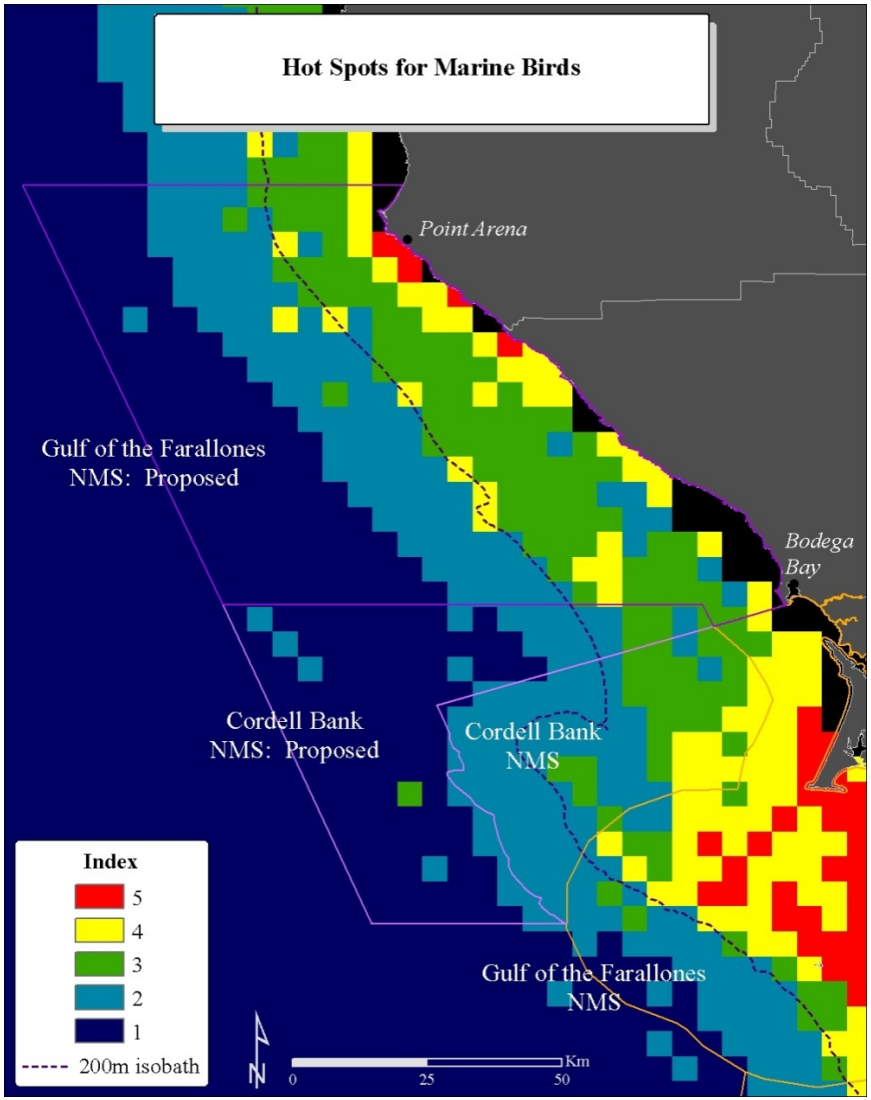
Conservation gap





Proposed Expansion Area

- Predicted ‘hotspots’ just south of Point Arena.
- Shelf area important foraging habitat for seabirds.



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Hotspots in current extent of GF and CB NMS

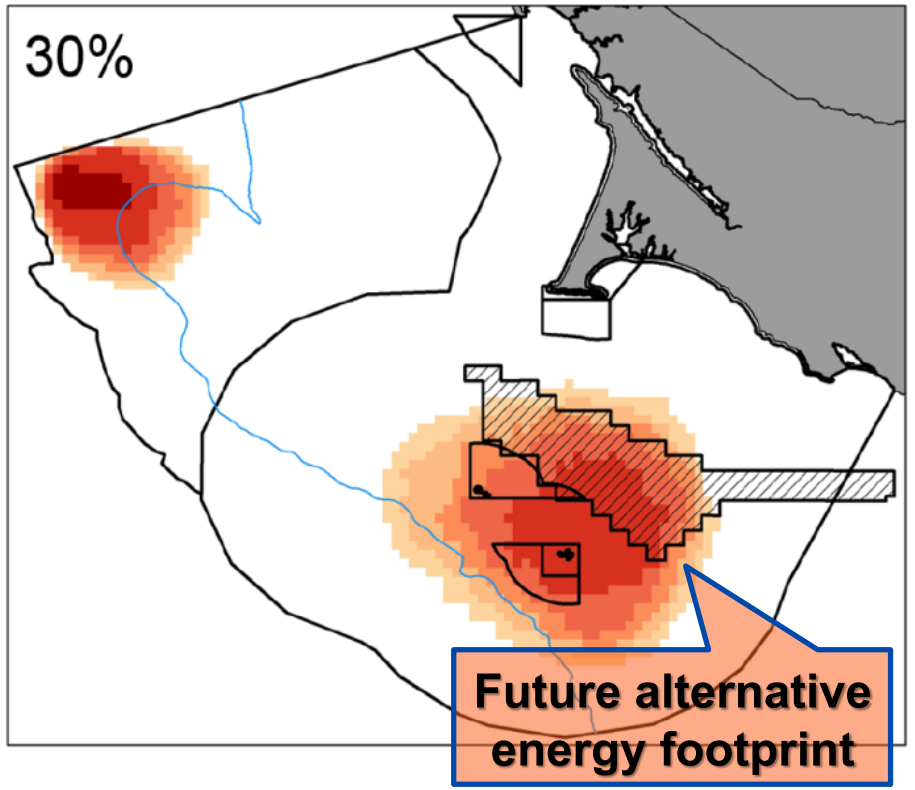
Common Murre

Cassin's Auklet

Rhinoceros Auklet

Brandt's Cormorant

Western Gull



Our results show that the most important seabird habitat lies outside state Marine Protected Areas (MPAs) where threats from shipping, oil spills, and energy development remain.

Conclusions

- Bathymetric variables were more important in predicting ‘hotspots’.
- ‘Hotspots’ over the shelf often aligned well with current protected areas (e.g., National Marine Sanctuaries).
- ‘Conservation gap’ with important ‘hotspots’ from Cape Mendocino to Heceta Bank.

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