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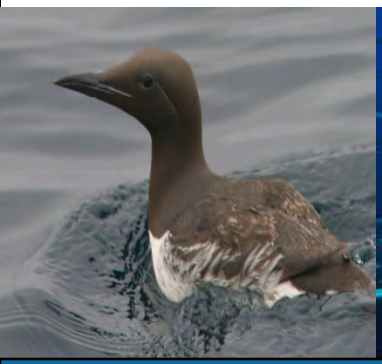




Wildlife ‘hotspots’ in the California Current

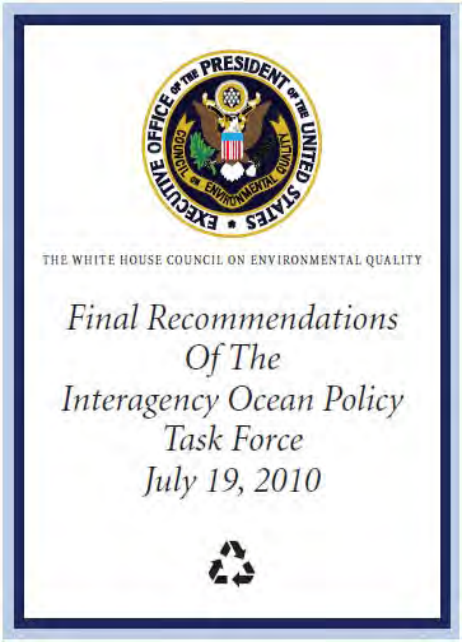
N. Nur, J. Jahncke, M. Herzog, J. Howar, D. Hyrenbach,
D. Ainley, J. Wiens, L. Ballance, K. Morgan, J. Zamon,
D. Stralberg, R. Robison, M. Diorio, J. Gass

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"

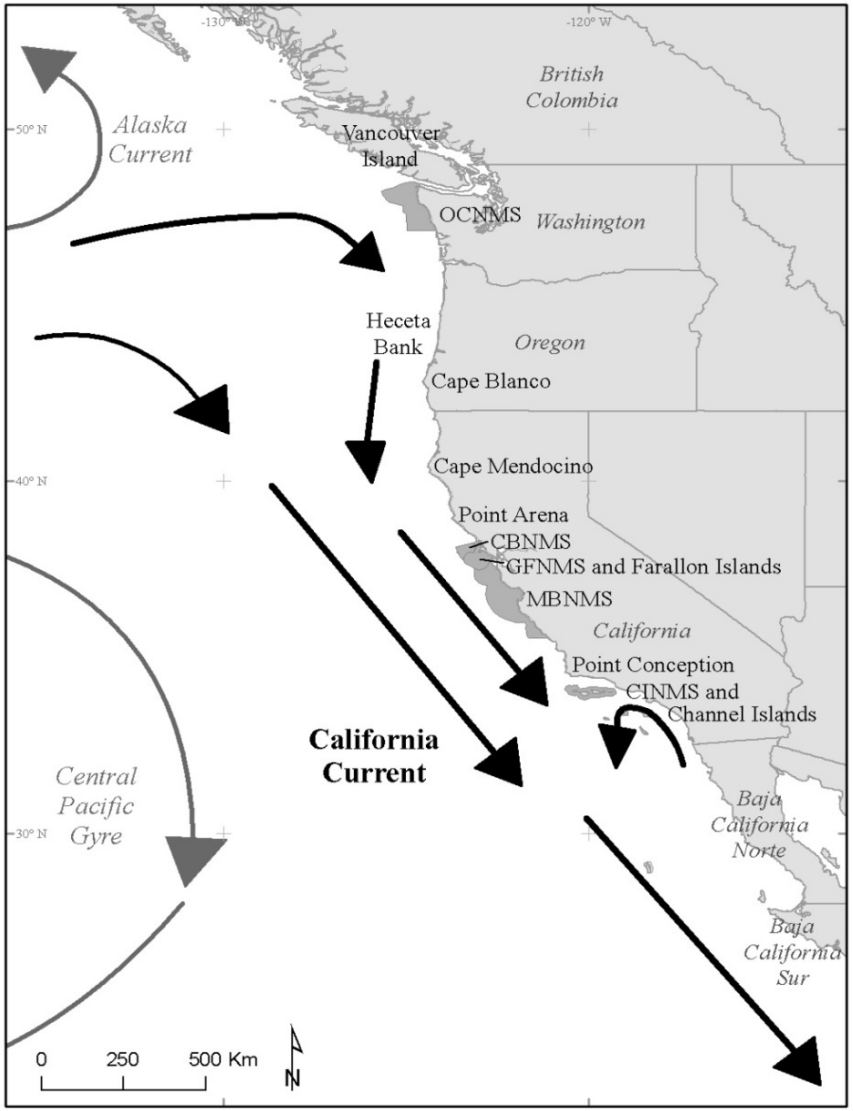


UNESCO

"it seeks to balance economic development and environmental conservation, and not focus only on the goals of conservation or protection"

Support marine conservation in federal waters

- Develop a methodology for identifying marine ‘hotspots’
- Apply this to the California Current System
- Provide results to inform marine spatial planning



Hypothesis

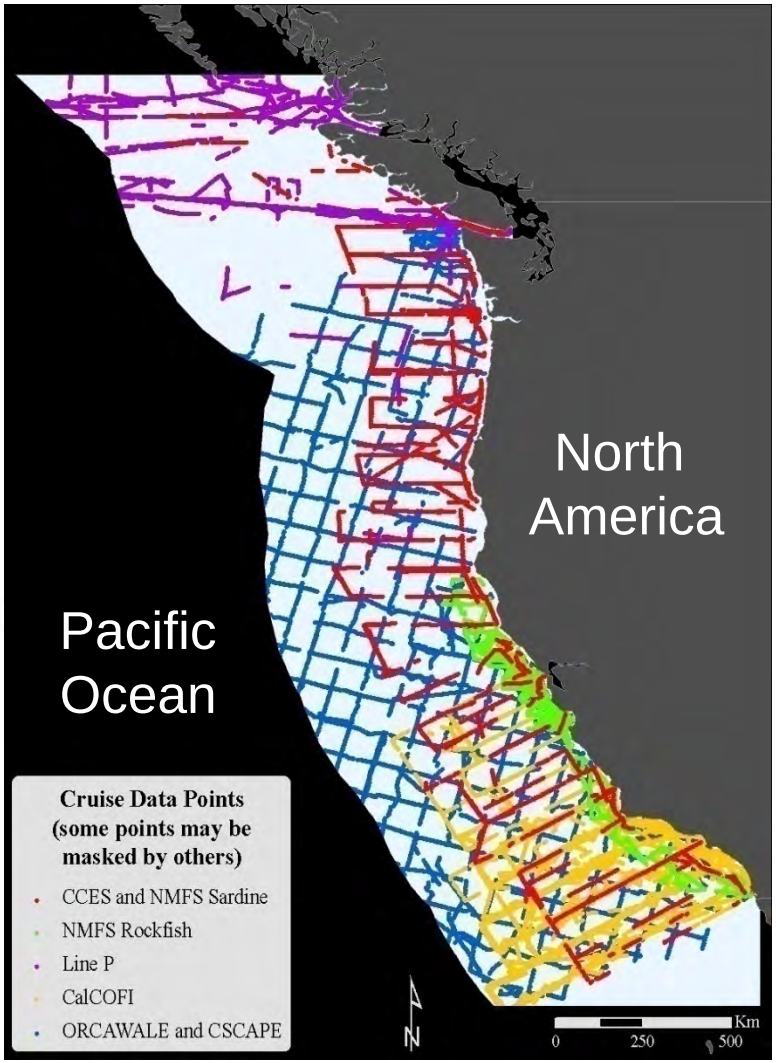
Marine birds aggregate to forage in predictable areas determined by bathymetric and oceanographic features.

Seabird data coverage

- Line P (1997 – 2006) 10yr
- 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

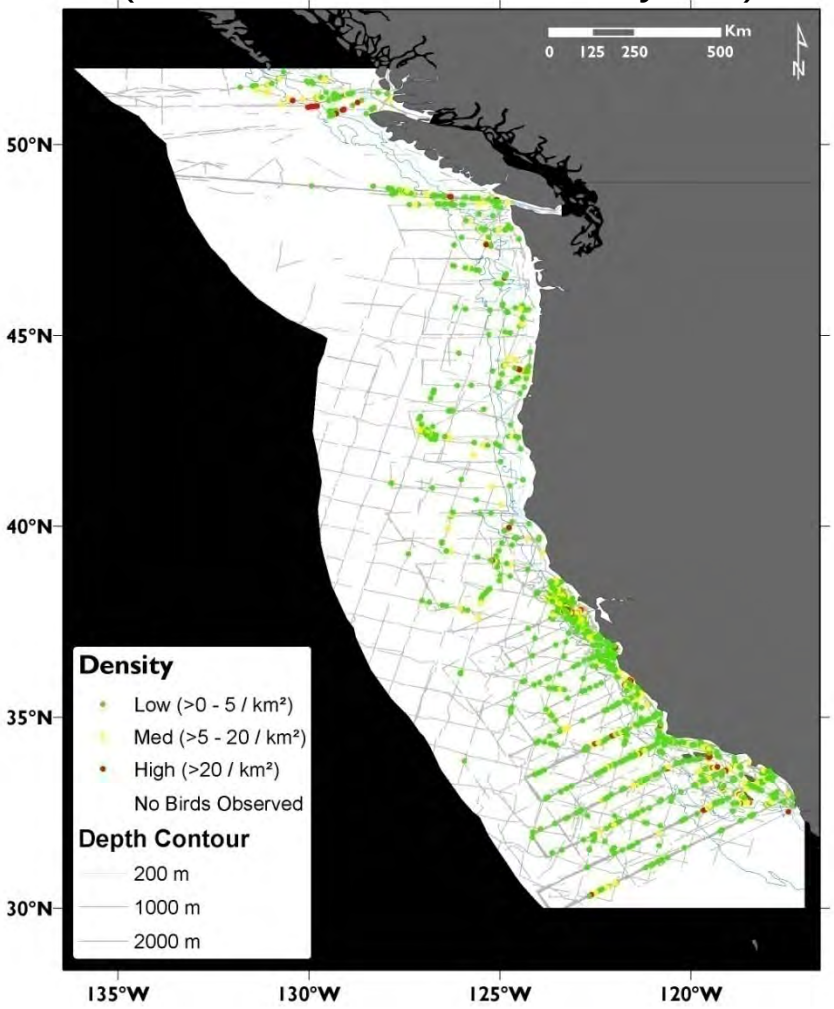
- Distance to nearest land
- Latitude

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)

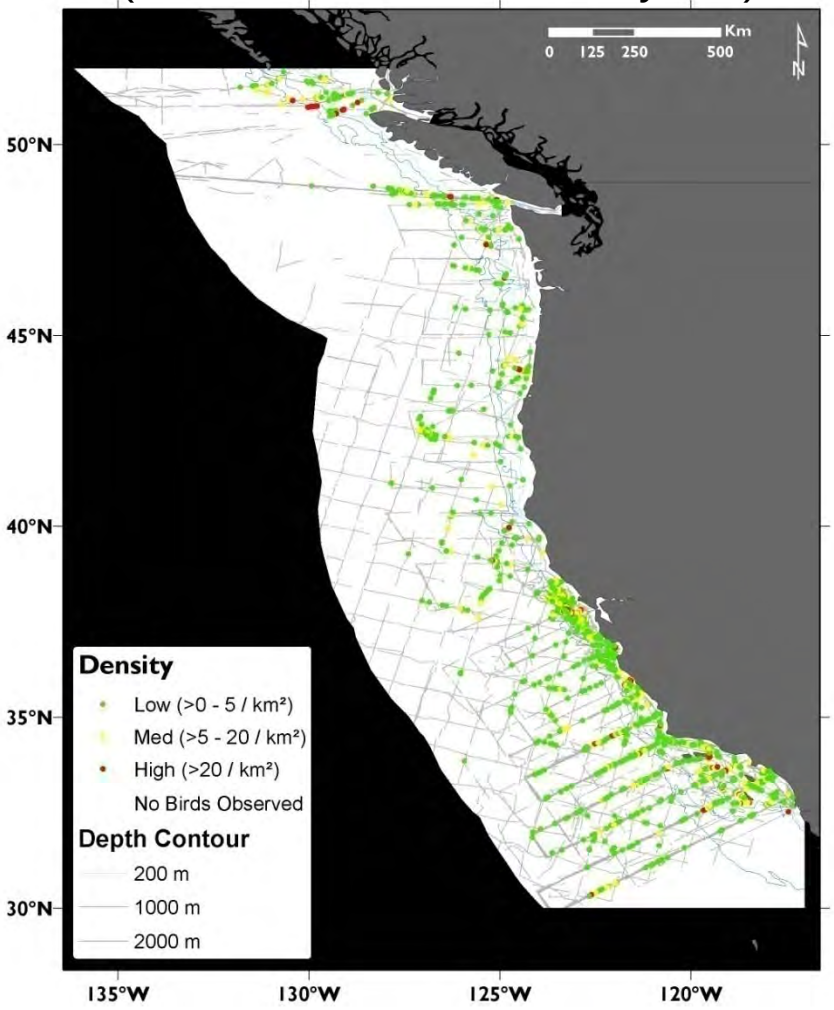
Observations and model – Cassin's Auklet

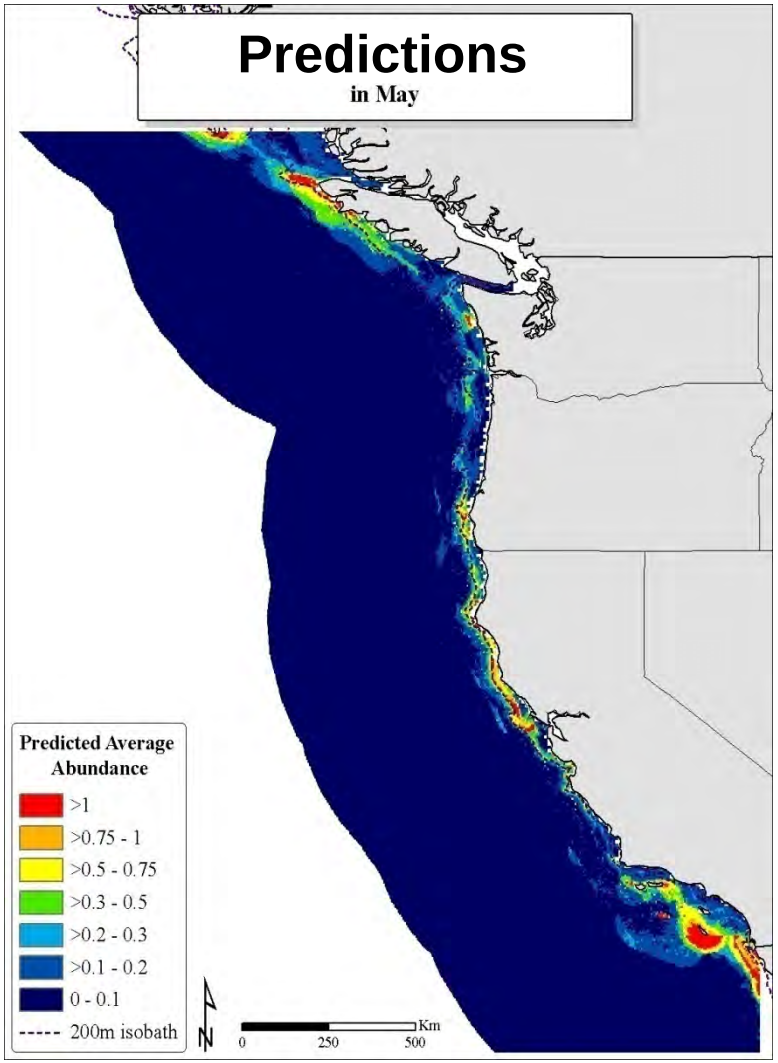
Observed data
(all cruises, all seasons, all years)



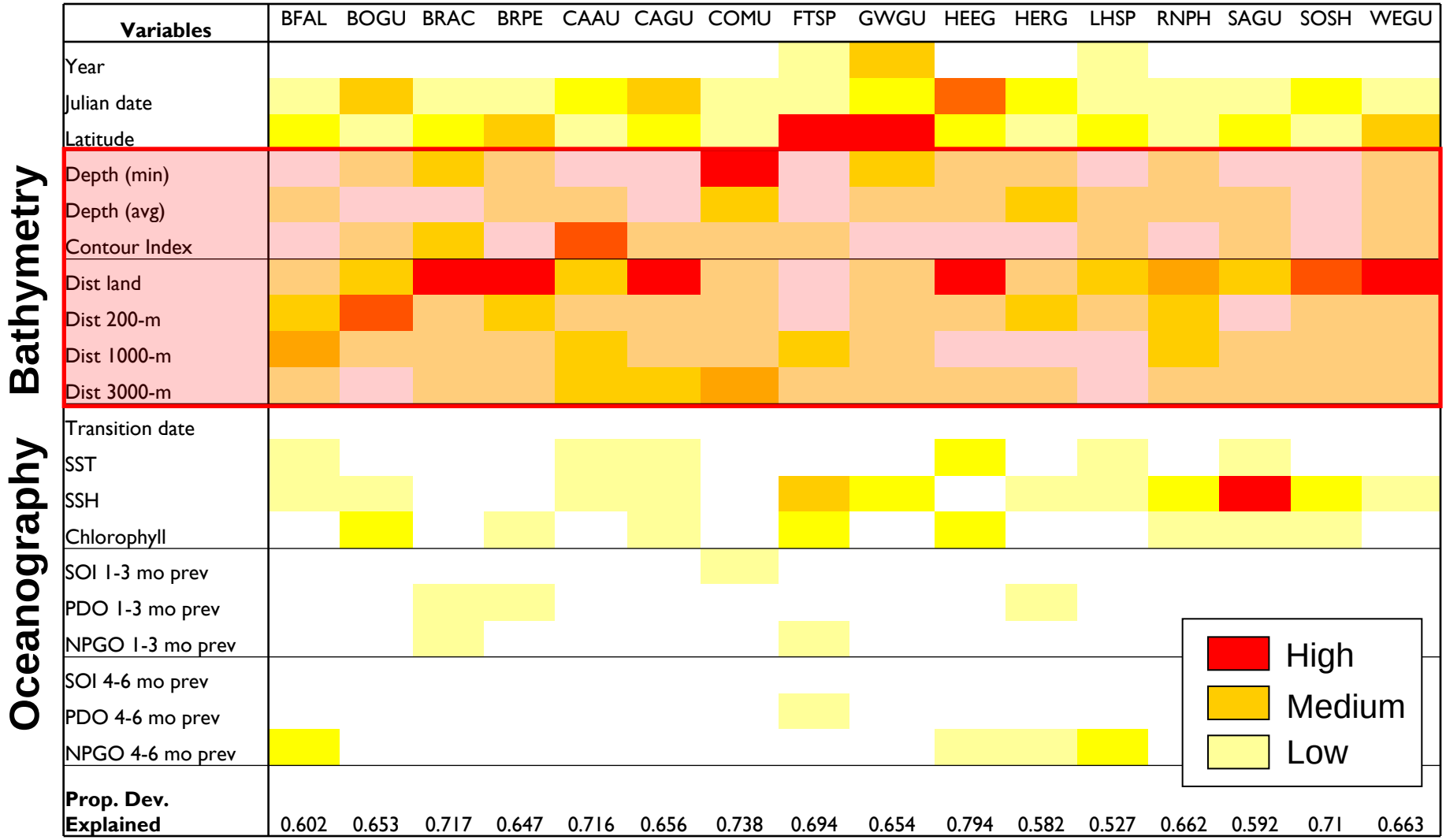
Observations VS Predictions – Cassin's Auklet

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





Model results – Location, Location, Location!



How did we use all these models?

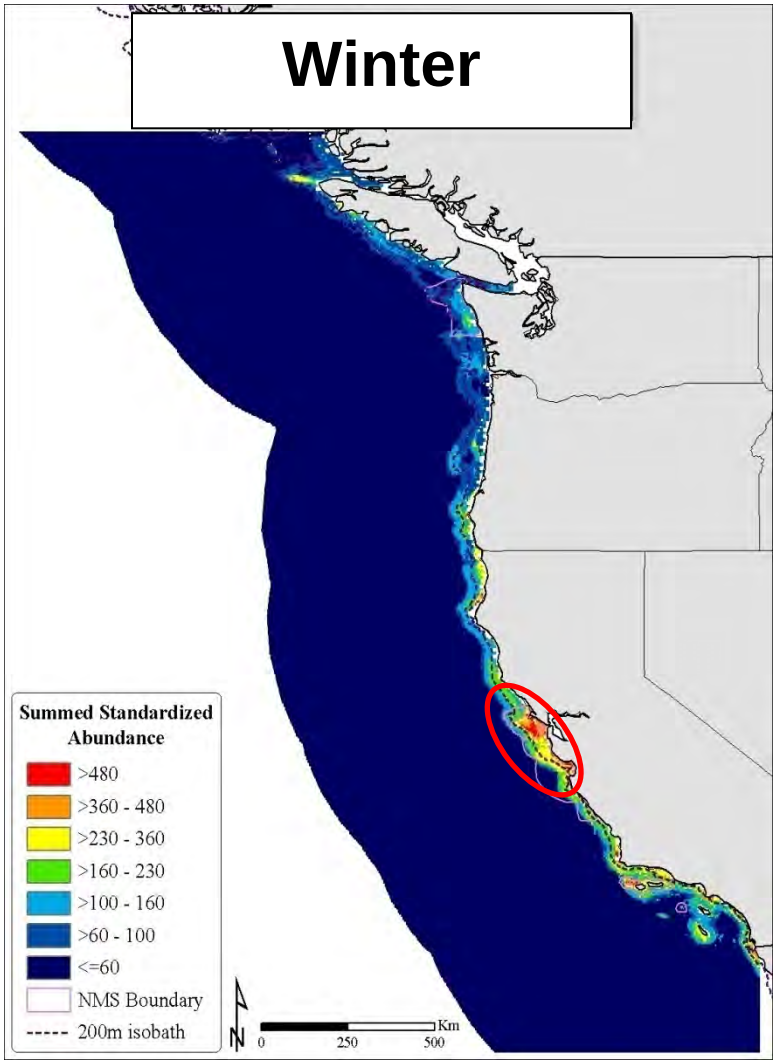
- **Abundance:** summed standardized abundance of all species (each spp contributes equally to product)

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

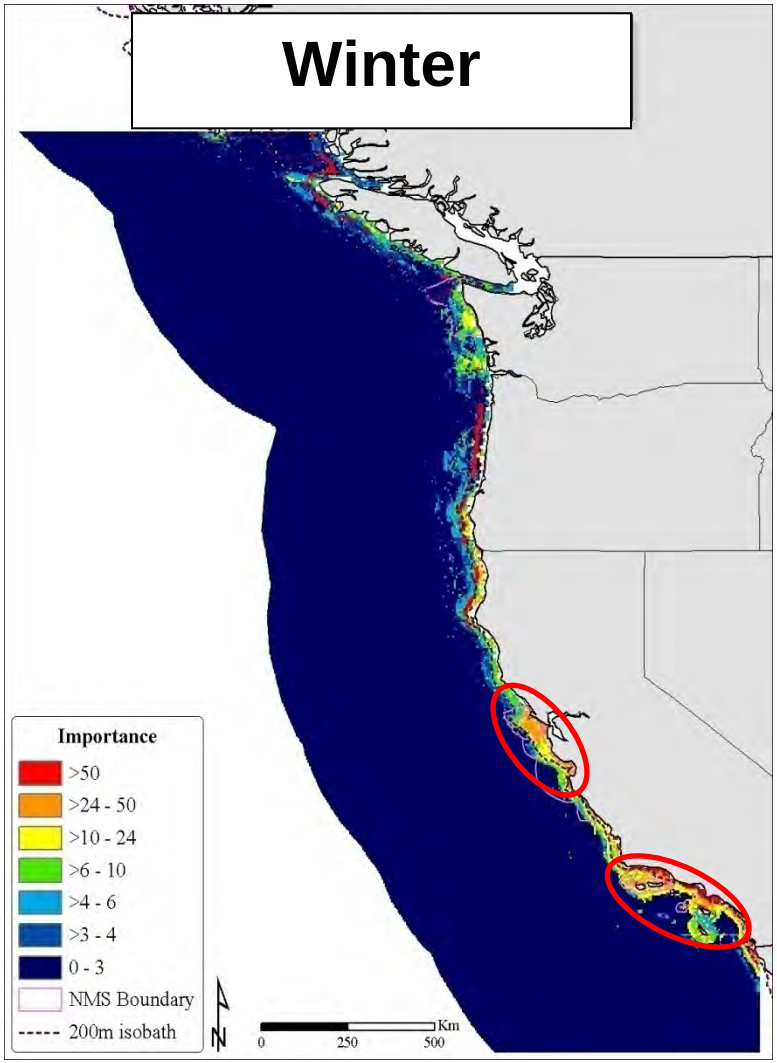
- **Persistence:** number of years that a cell was in the top 5% of predicted abundance for a particular species.

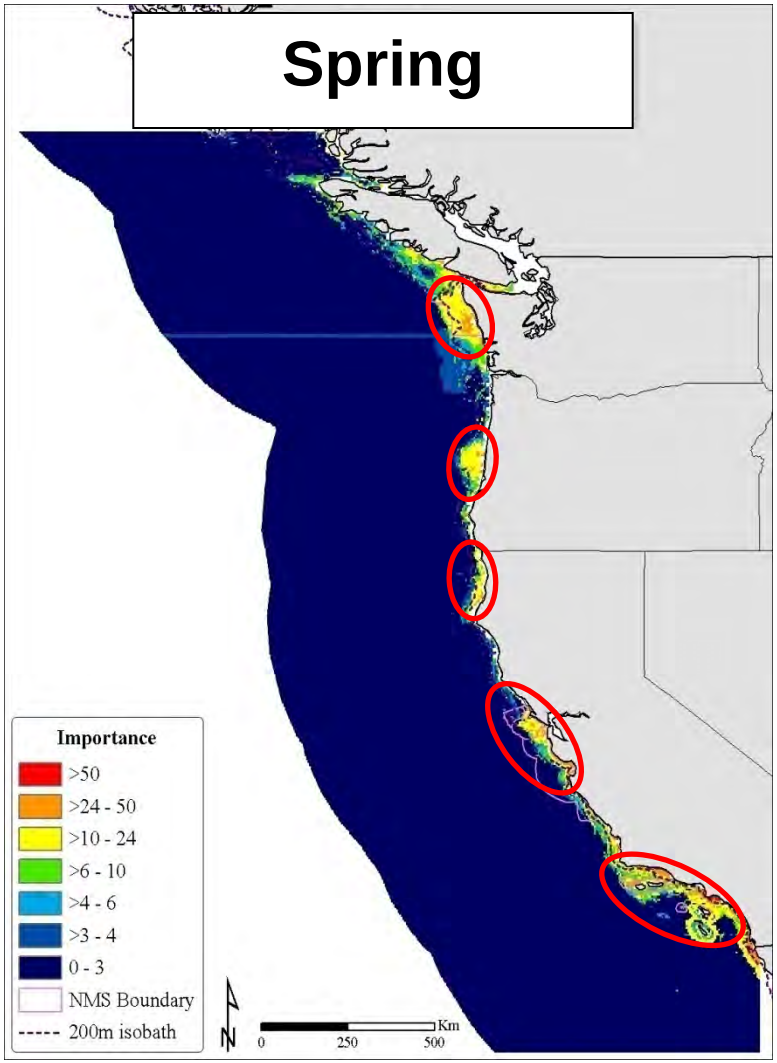
  These were calculated on a seasonal basis and averaged across all seasons.

Hotspots – ABUNDANCE

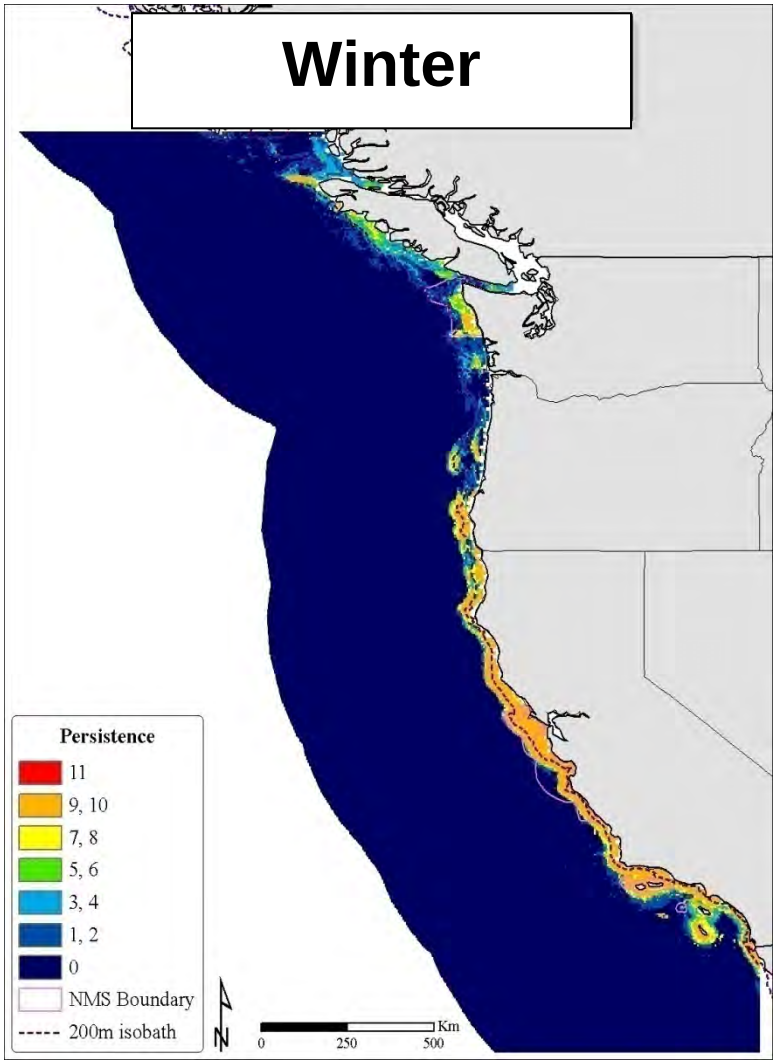


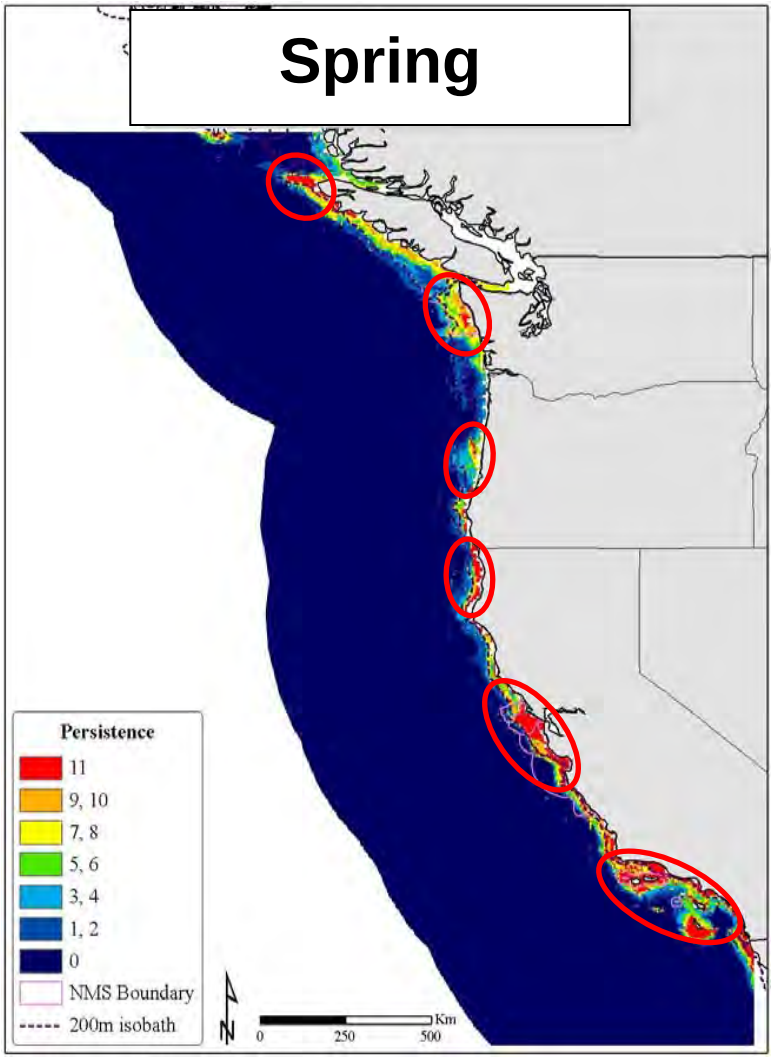
Hotspots – IMPORTANCE



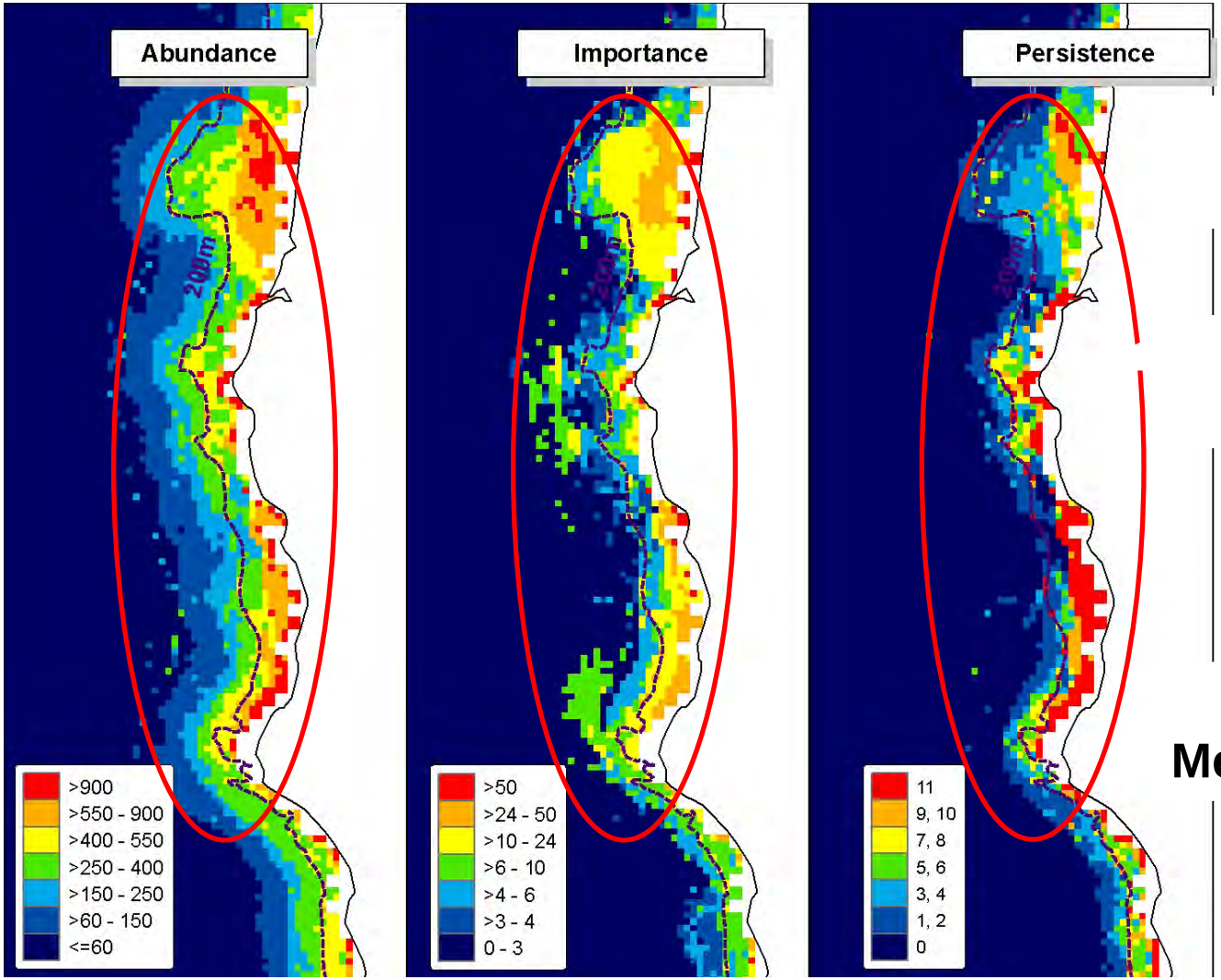


Hotspots – PERSISTENCE (top 5%)





Conservation Gaps



Conclusions

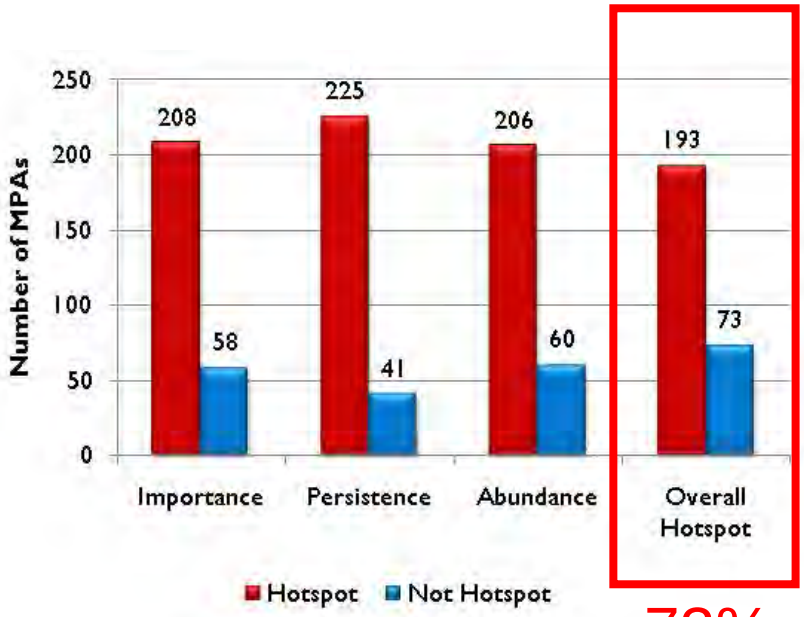
Ecological APPLICATIONS
A PUBLICATION OF THE ECOLOGICAL SOCIETY OF AMERICA

Coming soon…

- 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

Fishing Restrictions	Number of MPAs with Hotspot
Commercial and Recreational Fishing Prohibited	46
Commercial and Recreational Fishing Restricted	48
Commercial Fishing Prohibited	2
Commercial Fishing Restricted	27
Commercial Fishing Restricted and Recreational Fishing Prohibited	3
Commercial Fishing Prohibited and Recreational Fishing Restricted	22
Recreational Fishing Restricted	3
No Site Restrictions	39
Restrictions Unknown	3

56% have specific fishing restrictions

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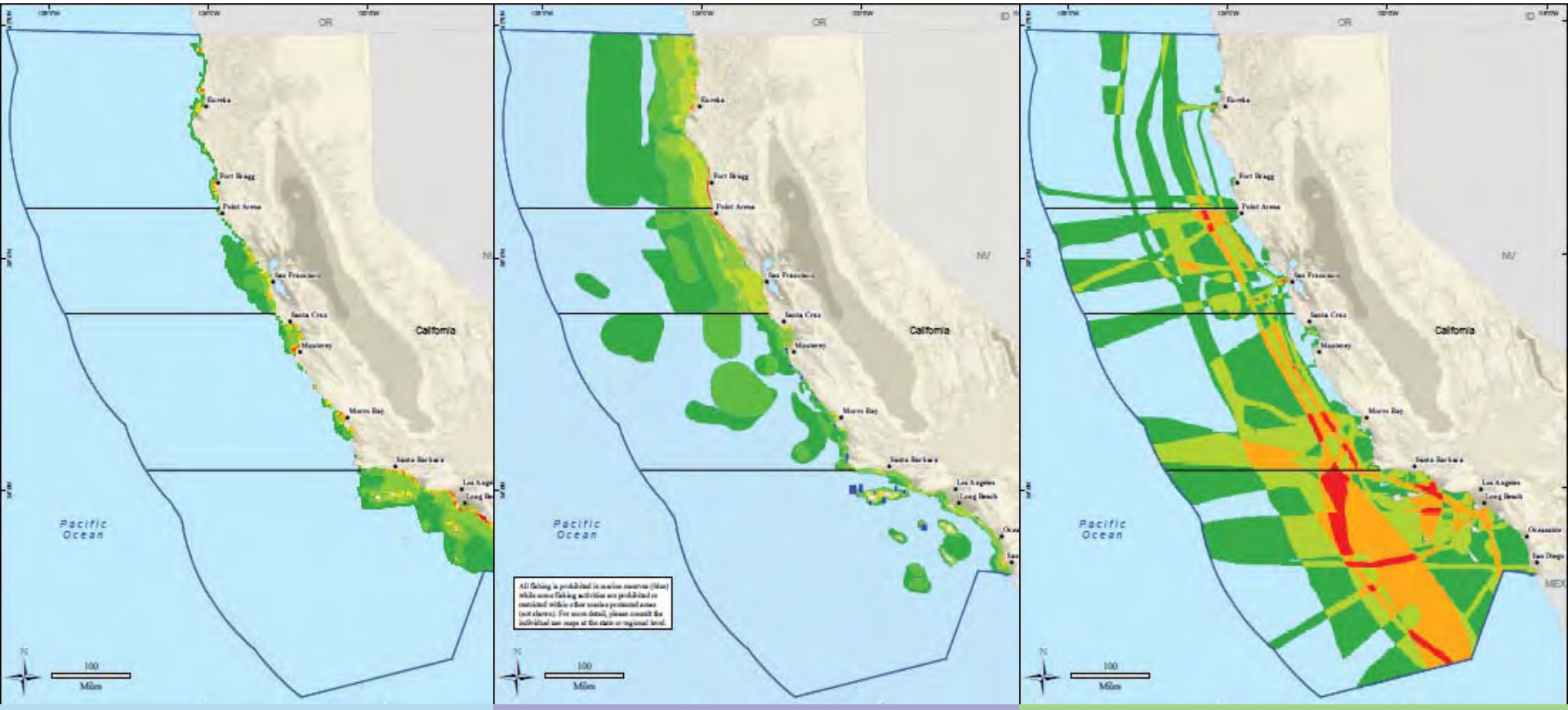
Next Step:

Threats assessment – California

Identify threats to further prioritize hotspots off California

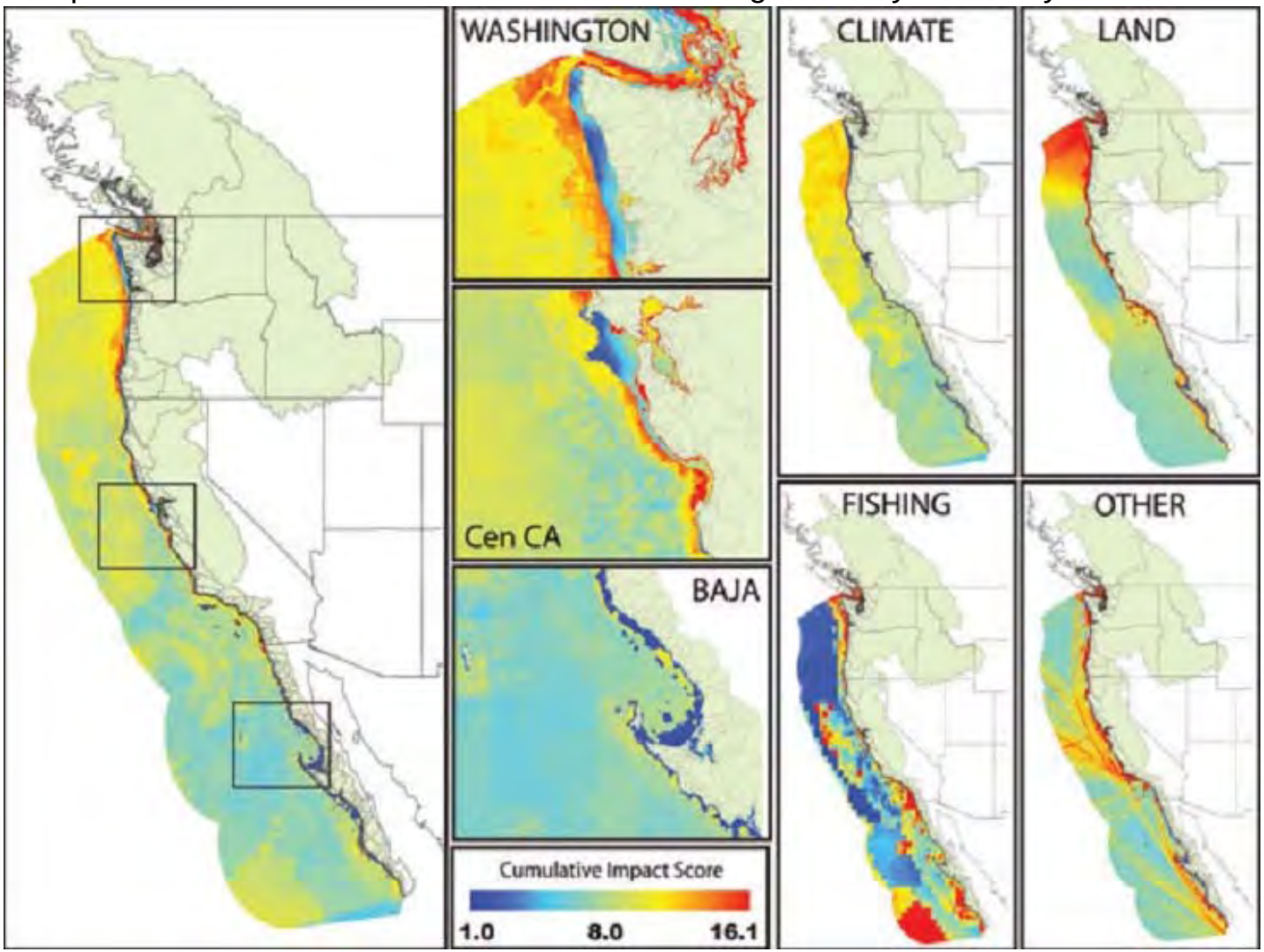


NON-CONSUMPTIVE | FISHING | INDUSTRIAL/MILITARY

Next Step:

Threats assessment – U.S. West Coast

Halpern et al. 2009 from National Center for Ecological Analysis and Synthesis



Atmospheric deposition
SST
UV
Ocean-based pollution
Nutrient input
Inorganic pollution
Organic pollution
Noise/light pollution
Recreational fishing
Invasive species
Commercial shipping
Ocean acidification
Sediment decrease
Demersal destructive
Coastal engineering
Demersal nondestructive high bycatch
Sediment increase
Marine debris (trash)
Human trampling
Demersal nondestructive low bycatch
Pelagic high bycatch
Coastal power plants
Oil rigs
Aquaculture
Pelagic low bycatch
Climate
Land-based
Other
Fishing

Next Step:

Downscaling models to inform management

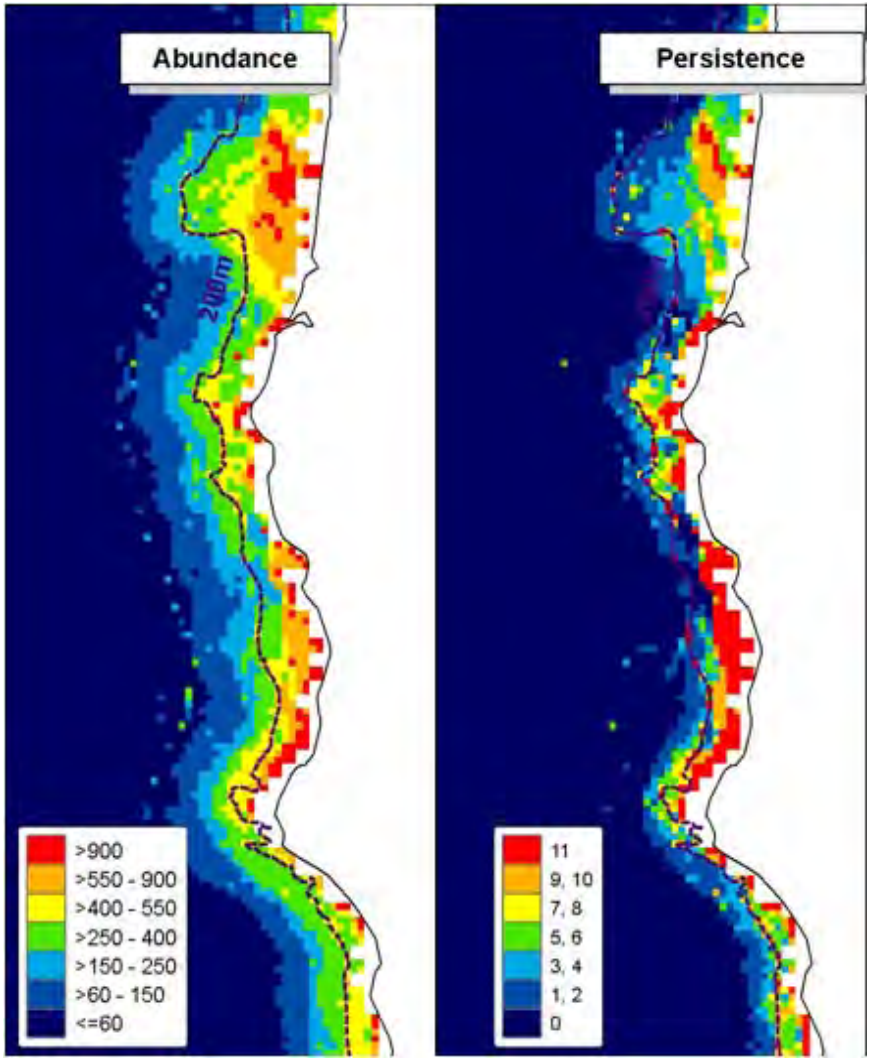
Develop predictive models that focus on specific areas

Information is important to support local management:

1.Heceta Bank

2.Klamath and Eel river

3.Northern Vancouver Is.



Acknowledgements

Resources Legacy Fund
National Fish and Wildlife Foundation
Moore Family Foundation
Faucett Family Foundation
Hellman Family Foundation
PRBO Donors

Glenn Ford, Ecological Consulting Inc.

Special Thanks to all those who implemented and maintained **CalCOFI, NMFS,** and **Line P** cruises

Daniel Fink for assistance with BDT programming

Emmanuelle Di Lorenzo for updating the NPGO

Thank you!