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PRBO Conservation Science

Using Science to Inform Marine Conservation

Jaime Jahncke

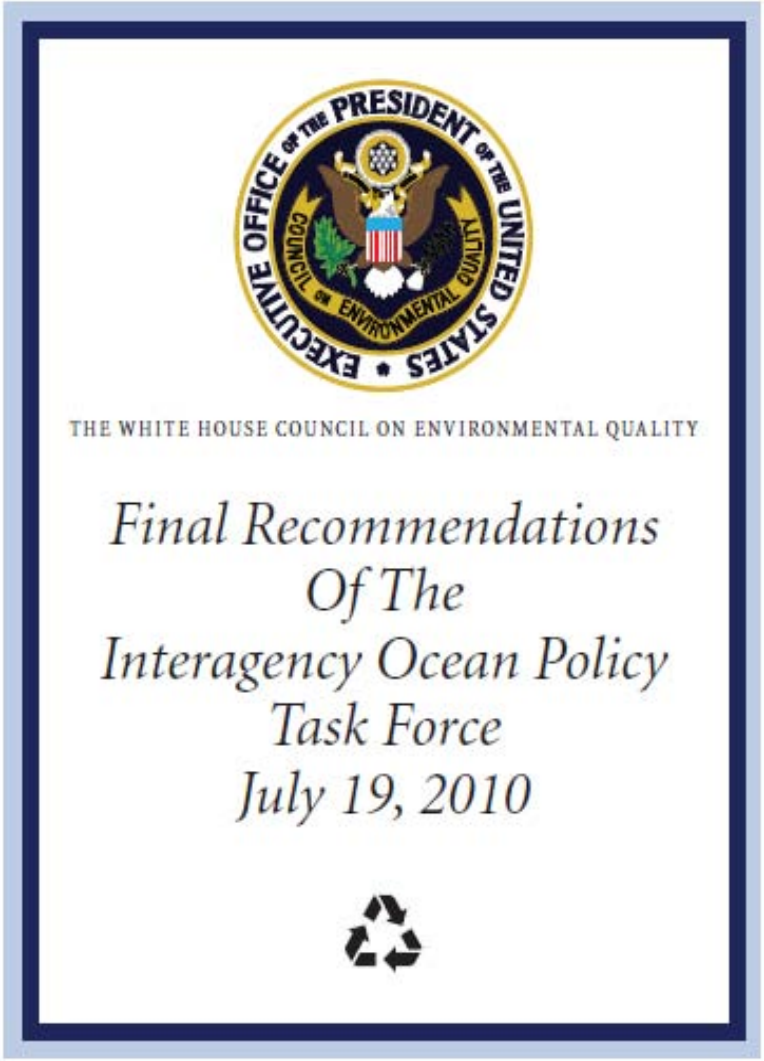
Presentation to GFNMS SAC – October, 2010

Marine Spatial Planning

- Support sustainable uses.
- Ensure resilient ecosystems
- Provide for the public
- Promote compatible uses
- Decrease governance conflicts
- Increase certainty in planning
- Enhance communications

"depends on sound scientific information"

"analyze current and anticipated uses of ocean"



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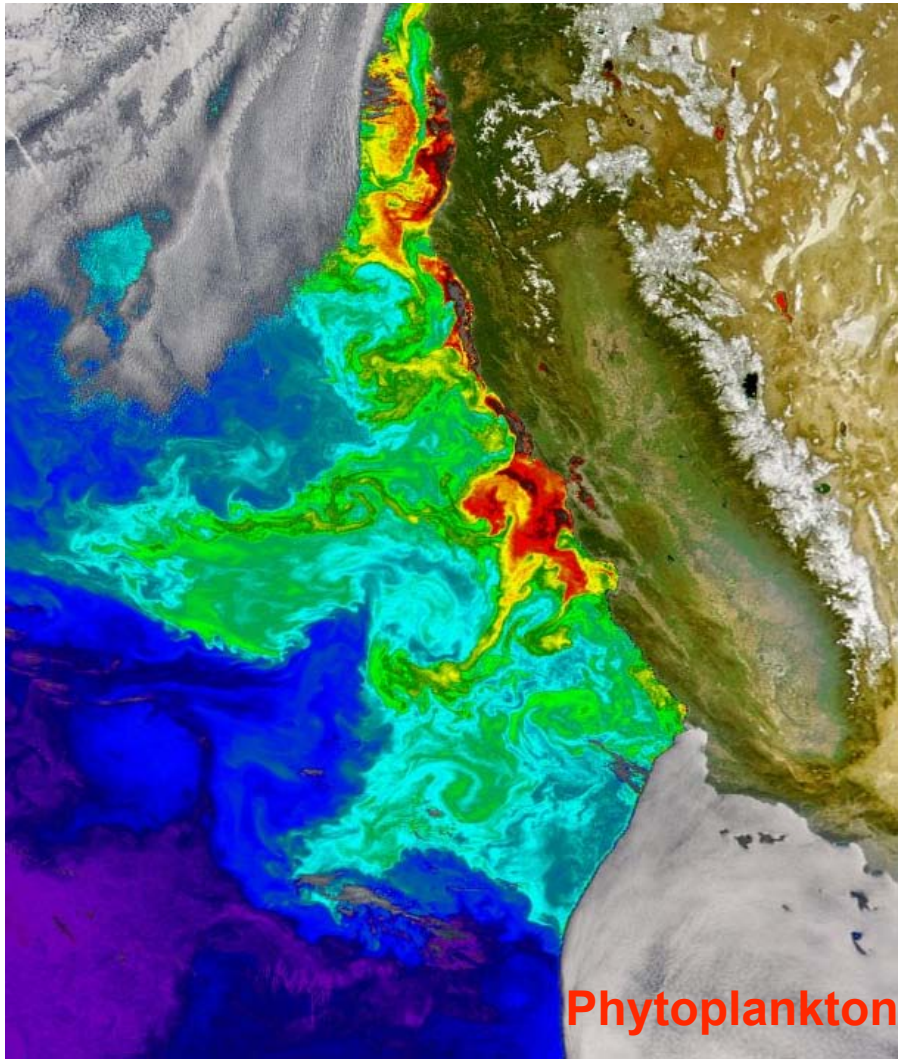
Support marine conservation

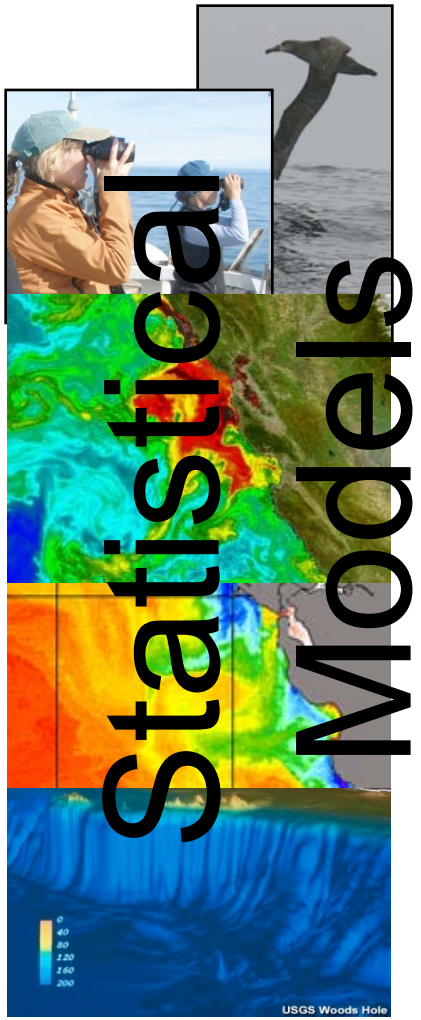
- Identify marine ‘hotspots’ in California Current System
- Use results to inform marine spatial planning in the U.S. West Coast.

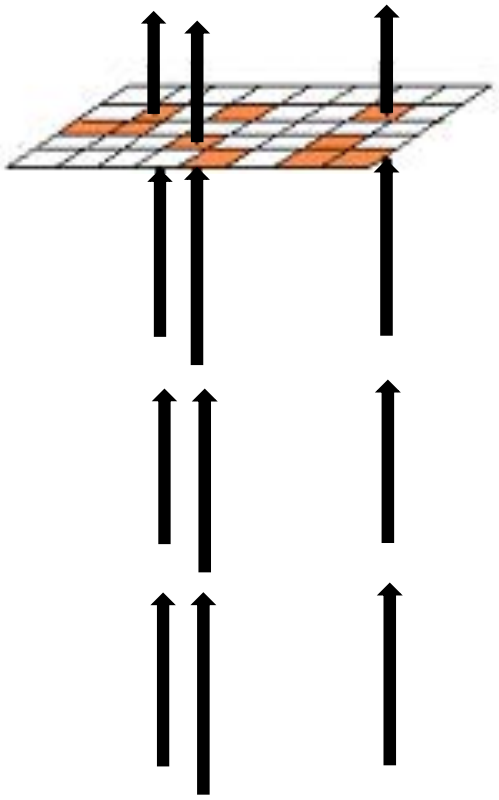


Hypothesis

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

How did we accomplish this work?



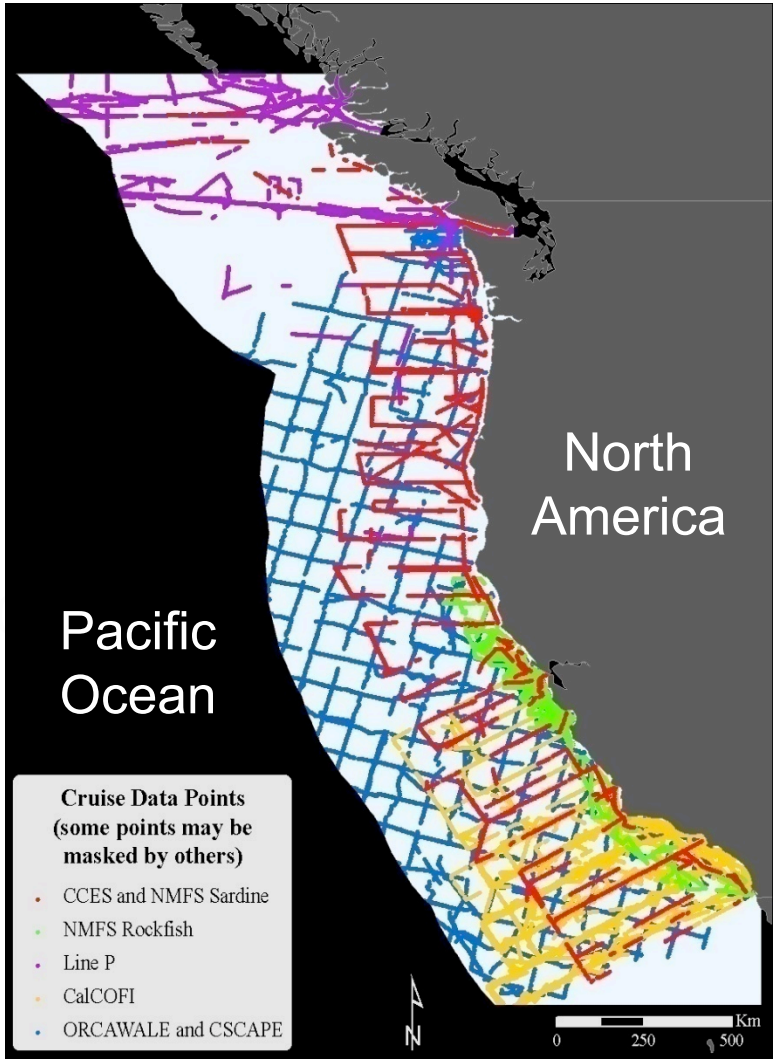


Top Predators

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

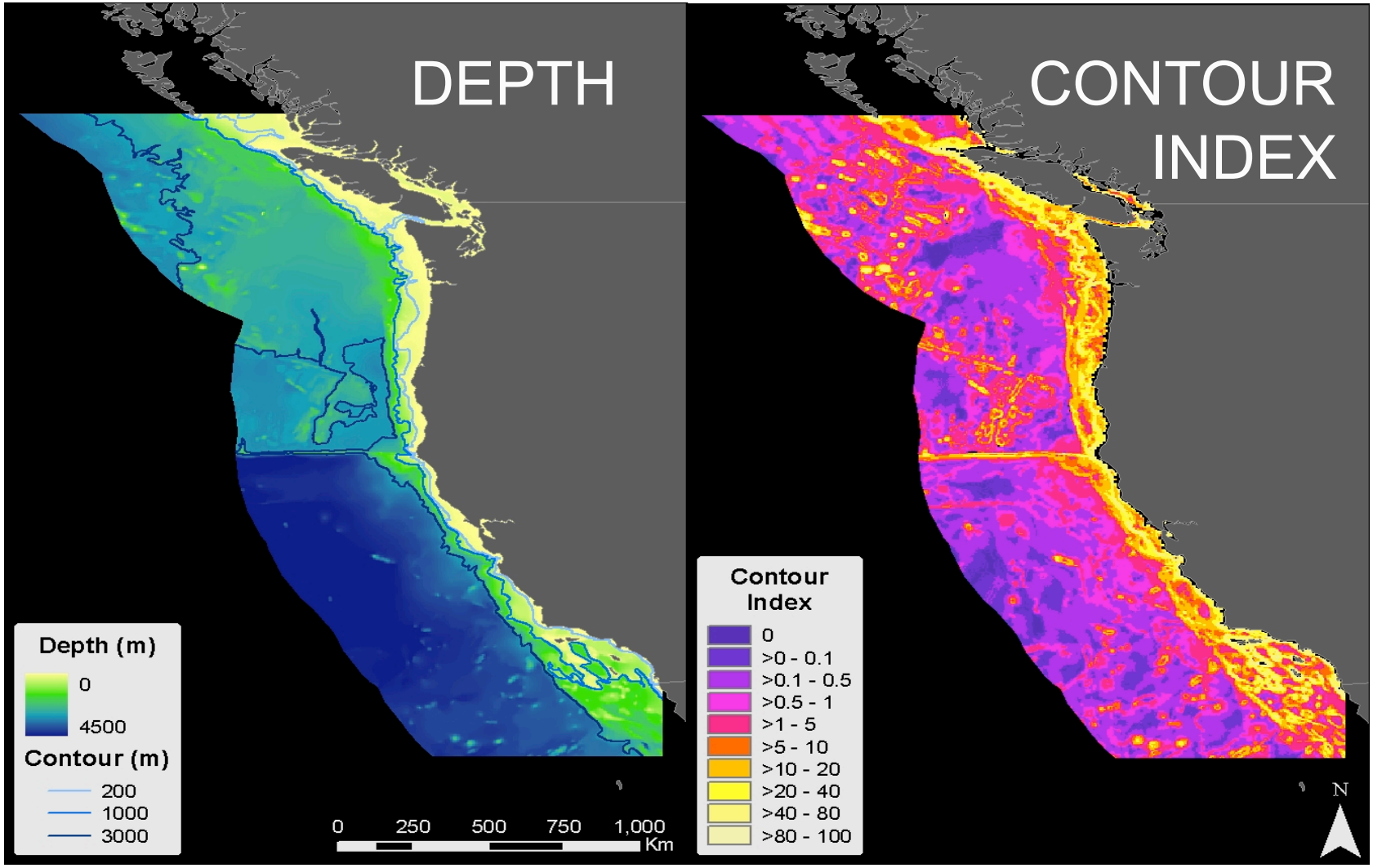
- Depth (minimum)
- Depth (average)
- Contour Index

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

Other

- Year
- Julian date
- Latitude

Variables – Bathymetry related



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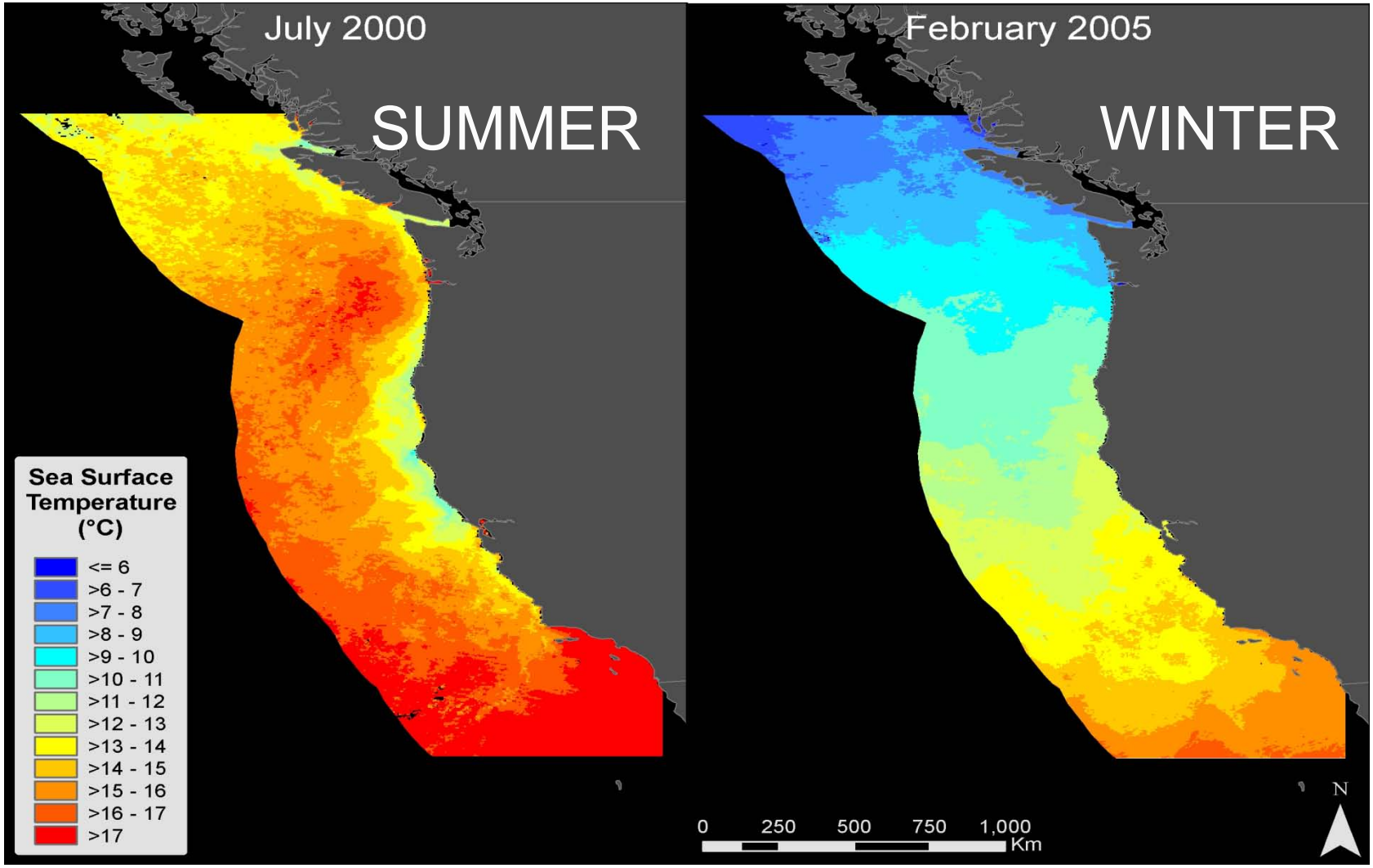
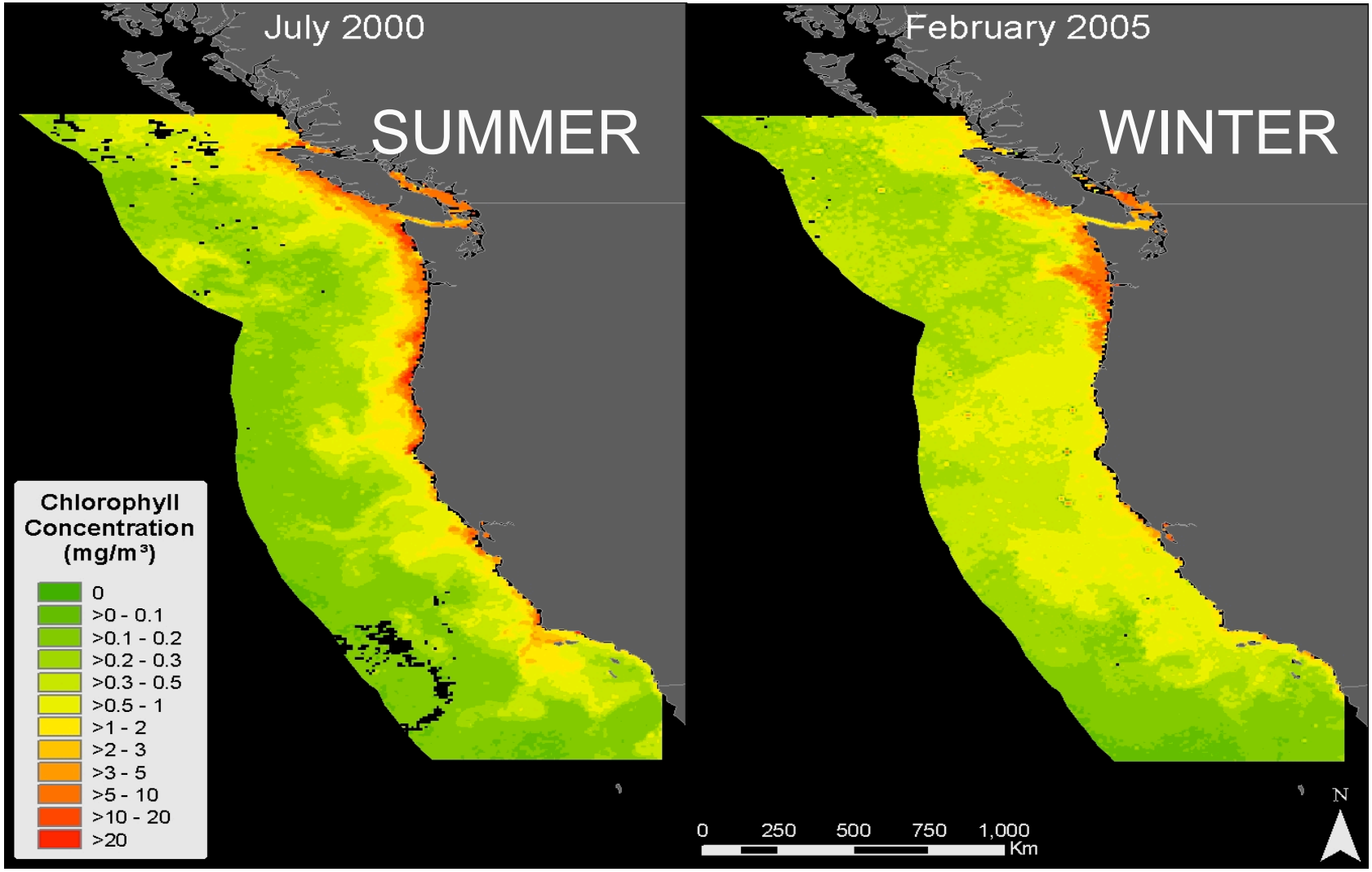
Variables – Sea Surface Temperature



Variables – Chlorophyll-a (productivity)



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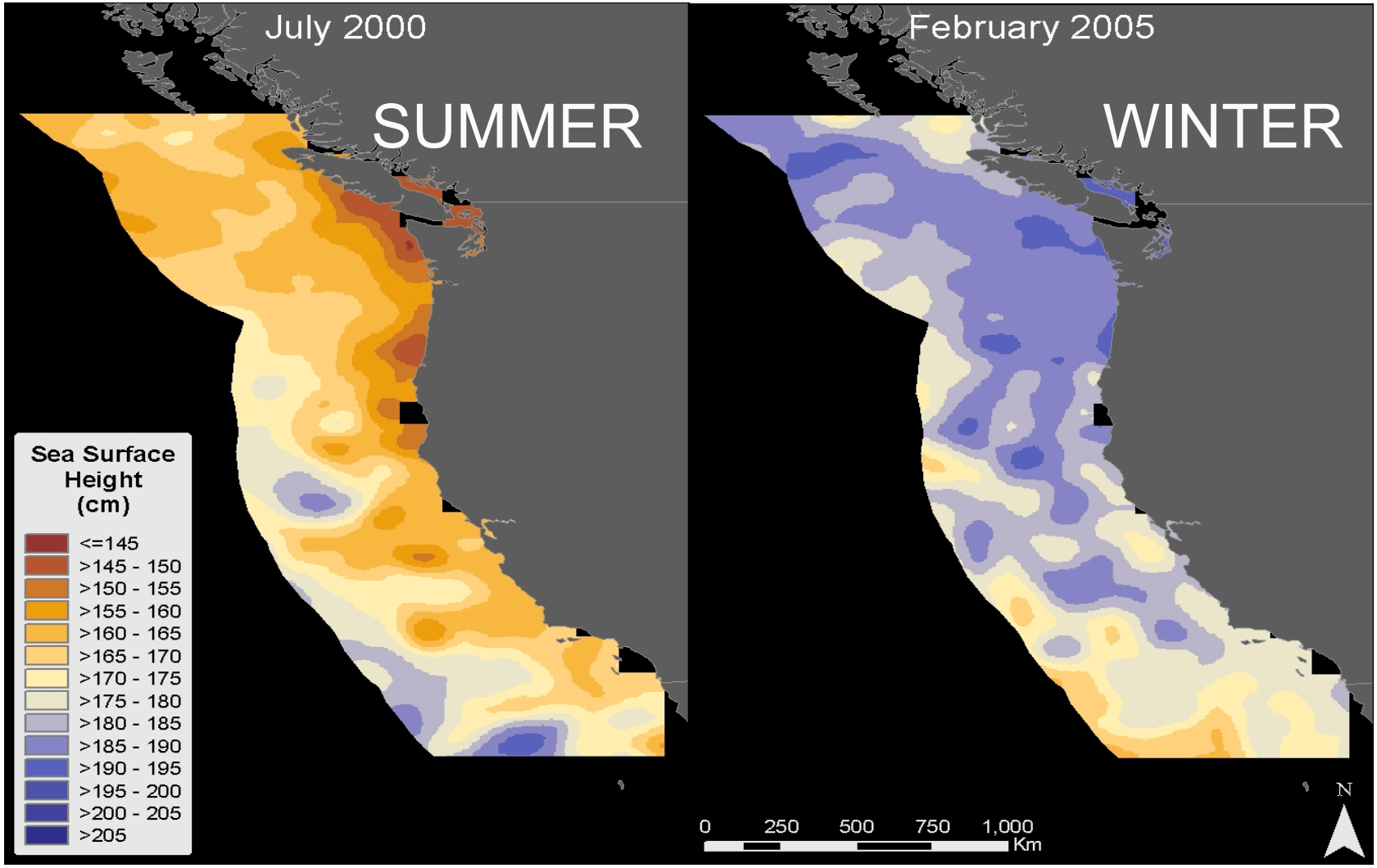
Variables – Sea Surface Height



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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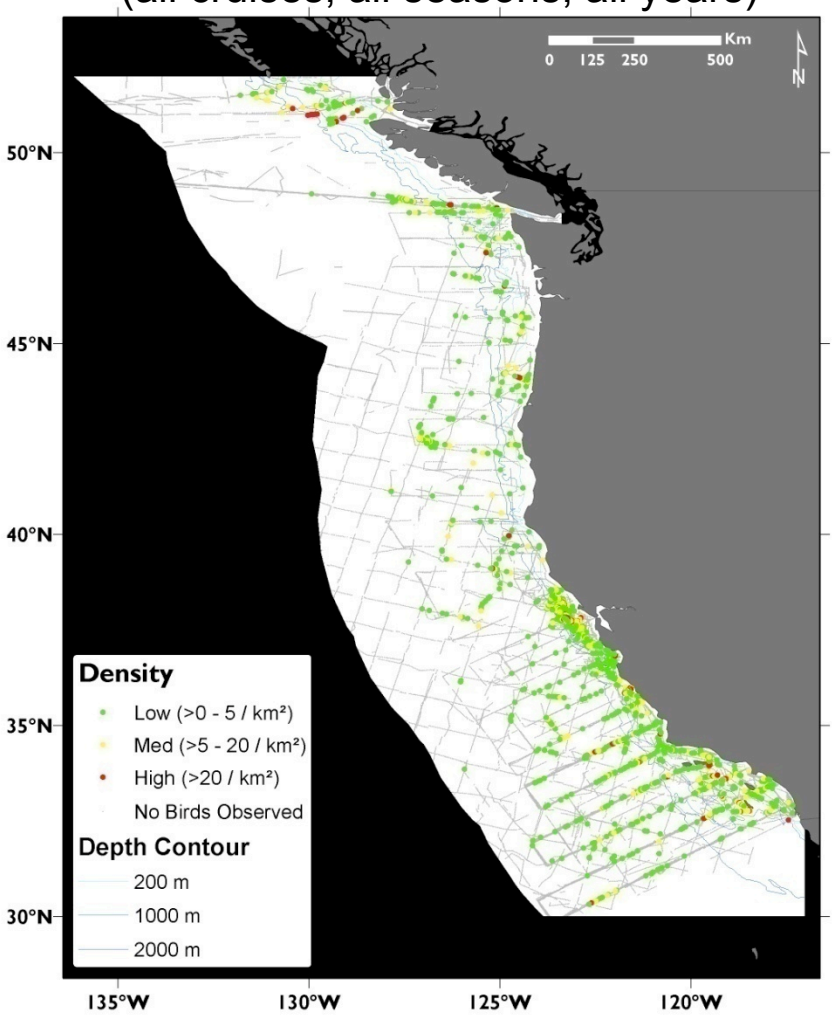
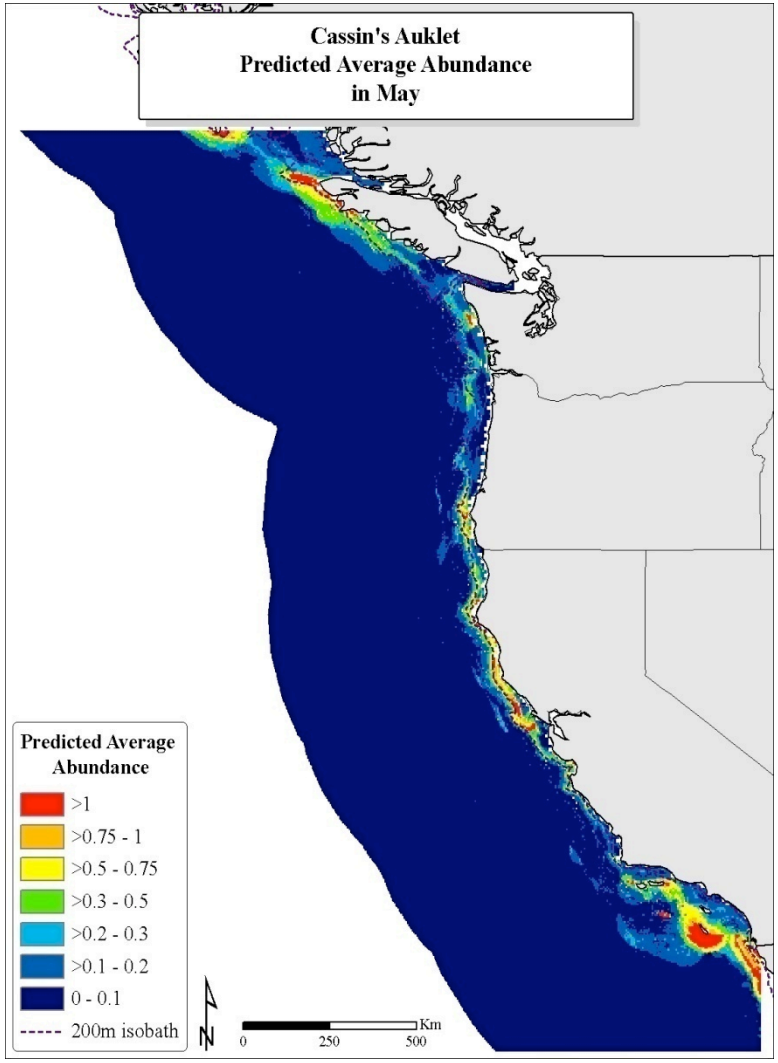
Observations VS Predictions – Cassin's Auklet

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





Cassin's Auklet - Oct 97 to Oct 08

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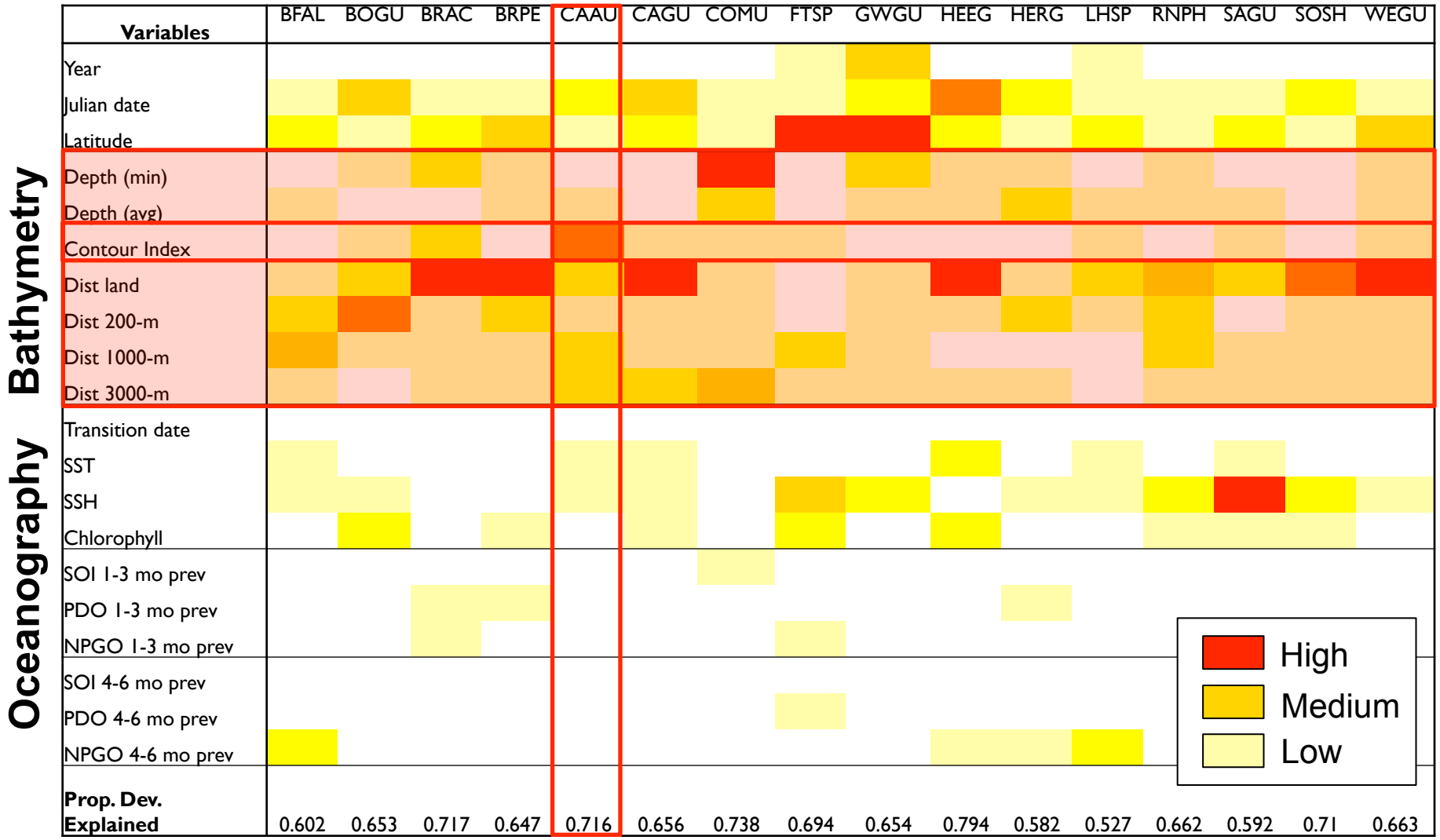
Model results – Location, Location, Location!



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.

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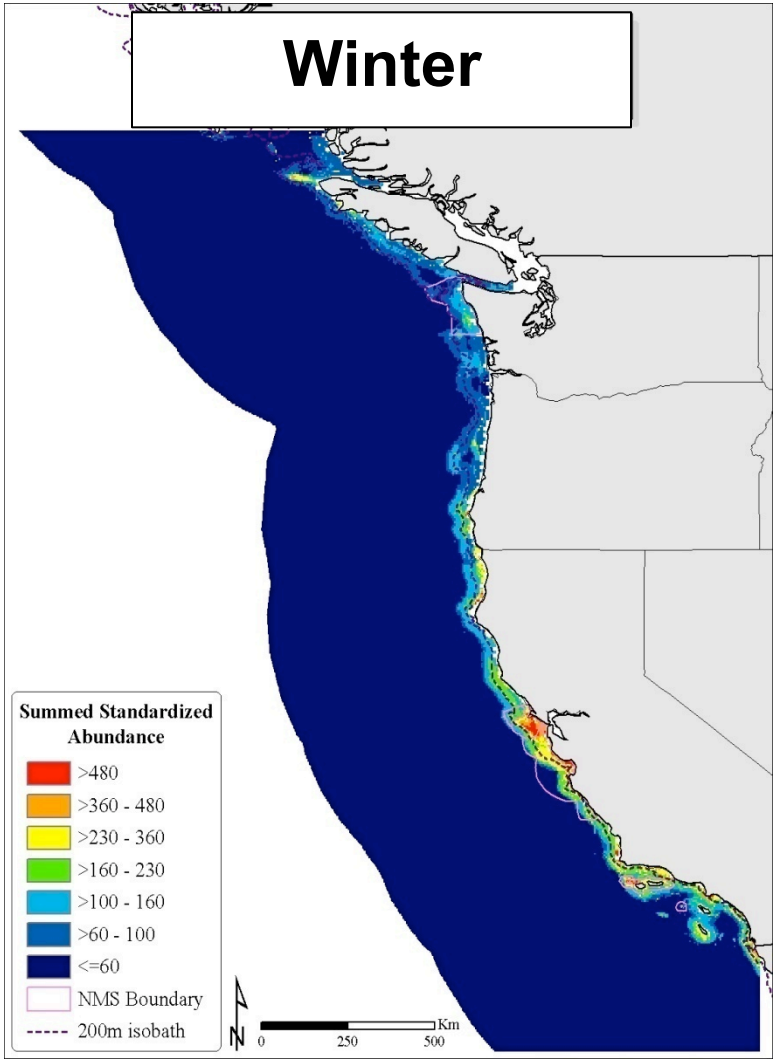
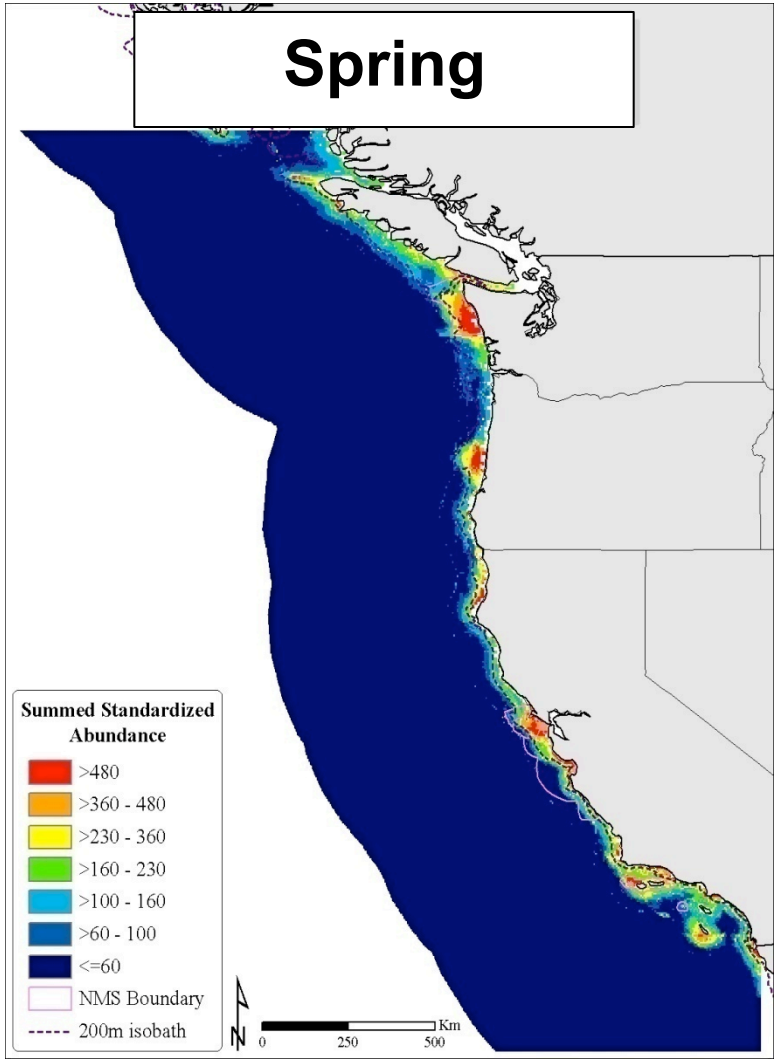
Hotspots – ABUNDANCE





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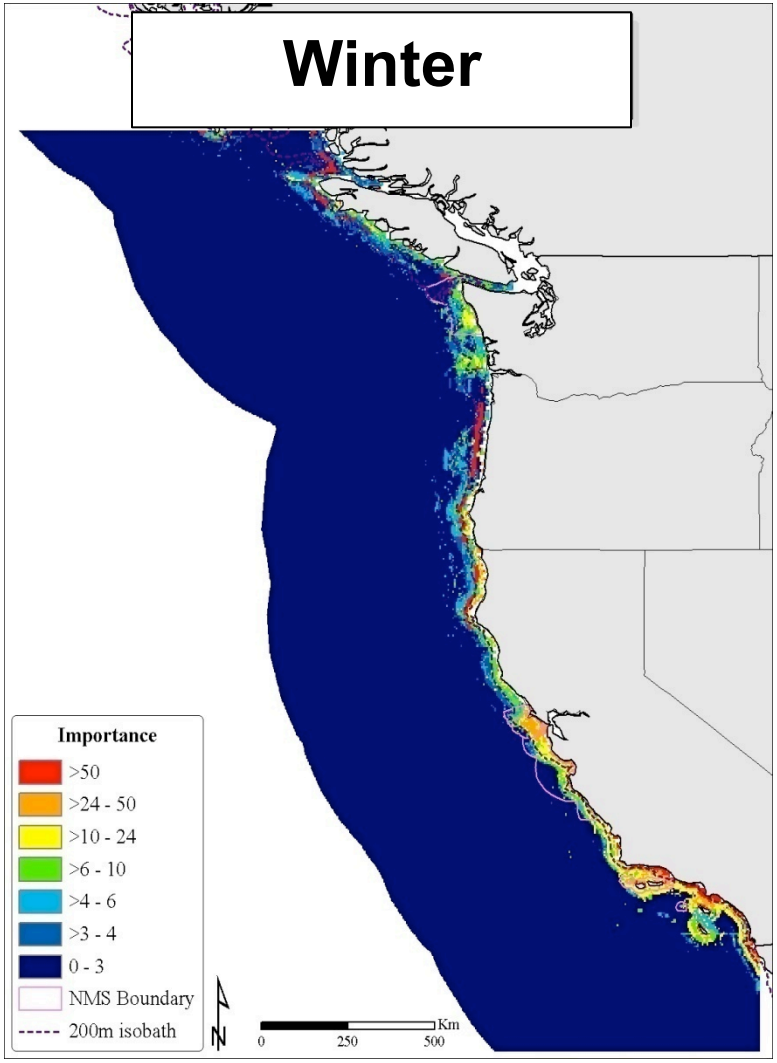
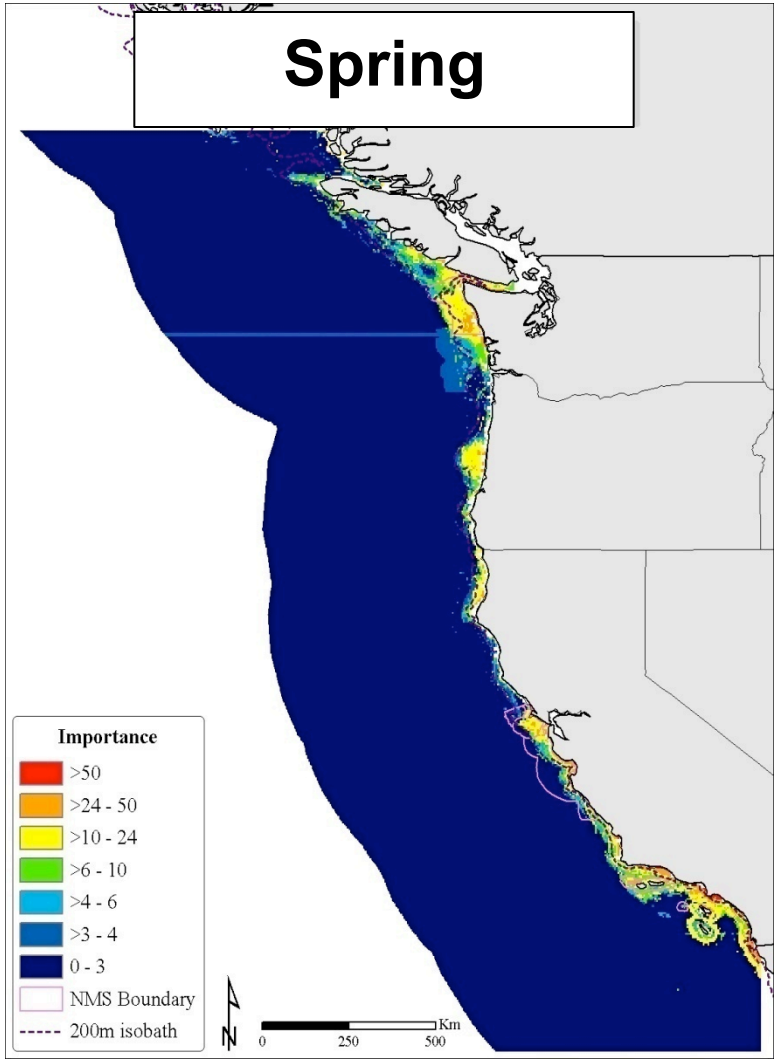
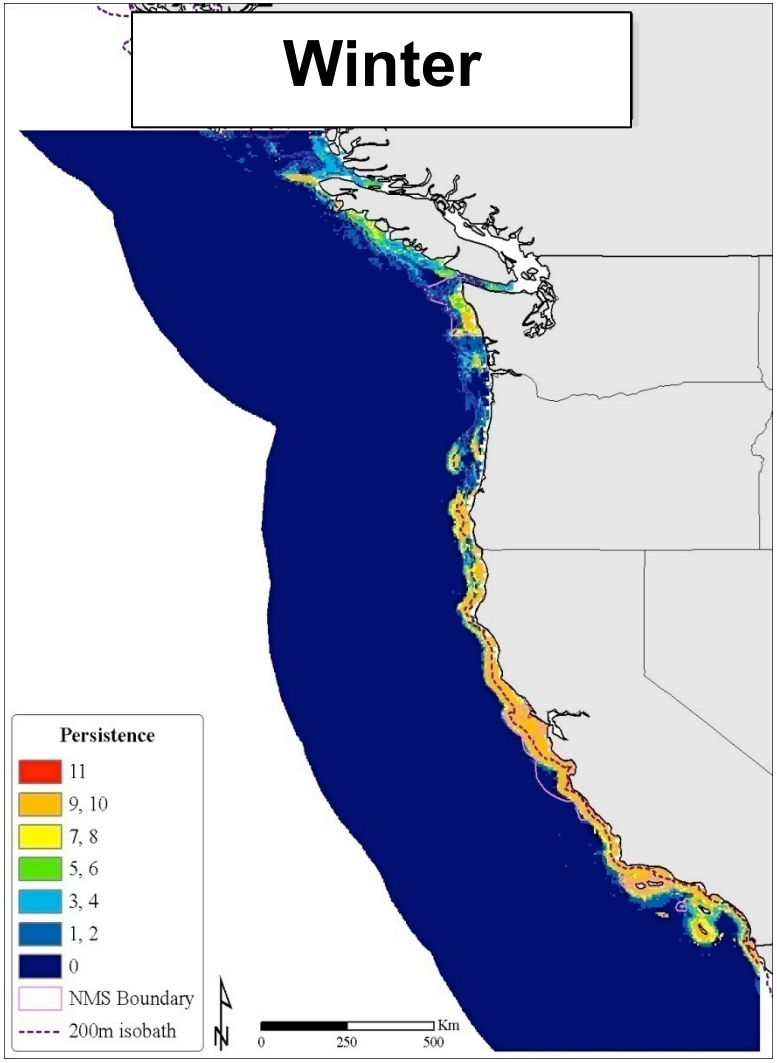
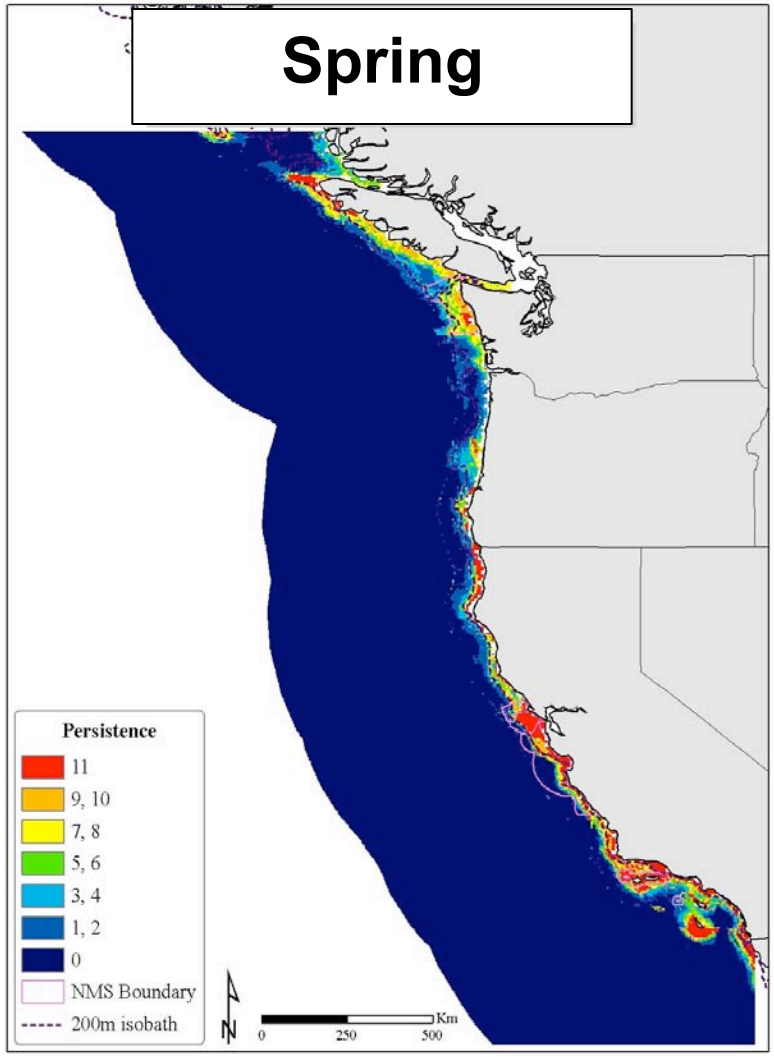
Hotspots – IMPORTANCE





Hotspots – PERSISTENCE (top 5%)





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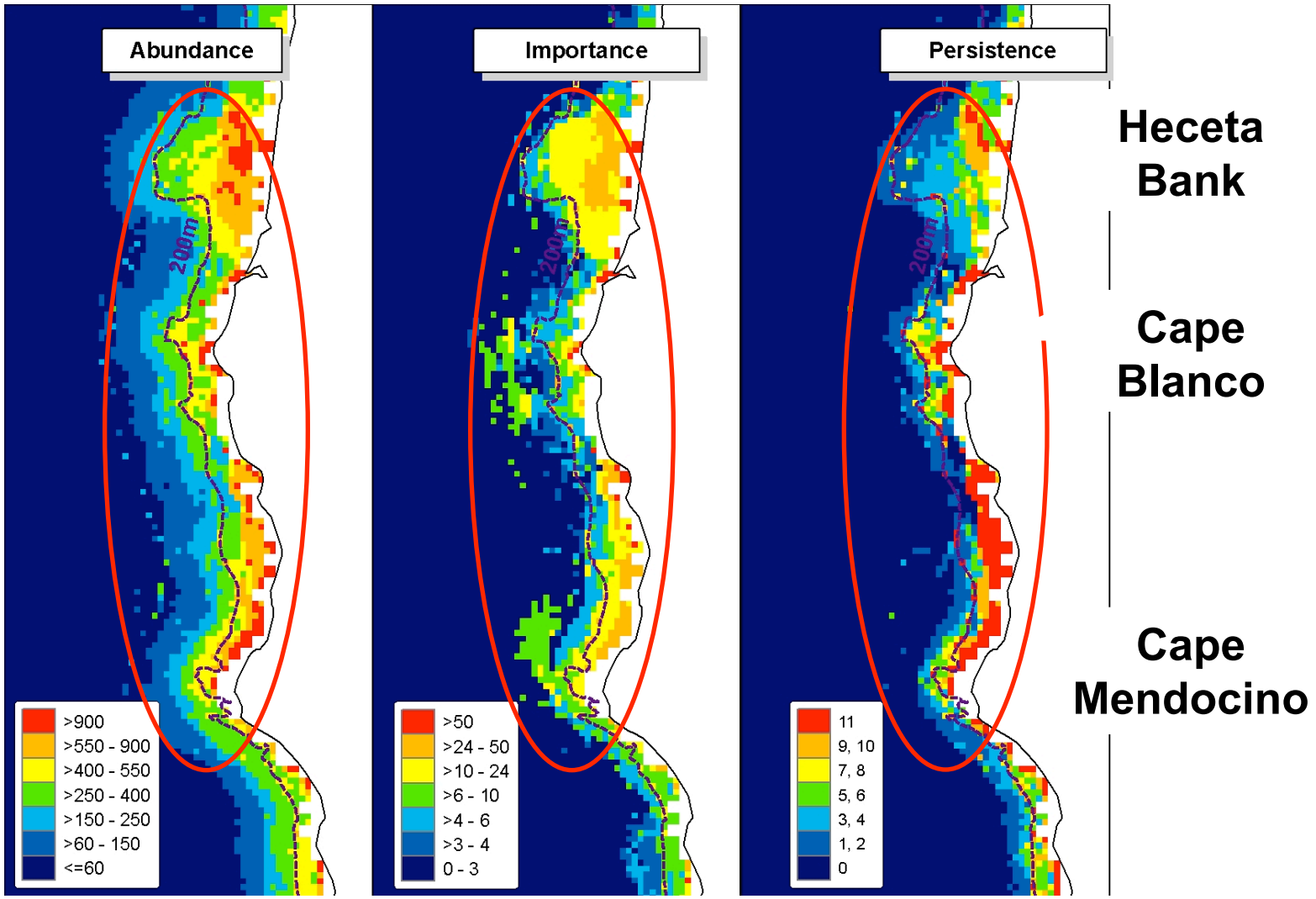
Conservation Gaps: A New Marine Sanctuary?



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Black-footed Albatross – ENDANGERED (IUCN)

Conclusions

- 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.

Next Step 1: Conservation gap assessment

Work with National MPA Center to assess conservation gaps along U.S. West Coast.

Identify overlap between current MPAs and wildlife hotspots that considers the specific regulation in place at each MPA.

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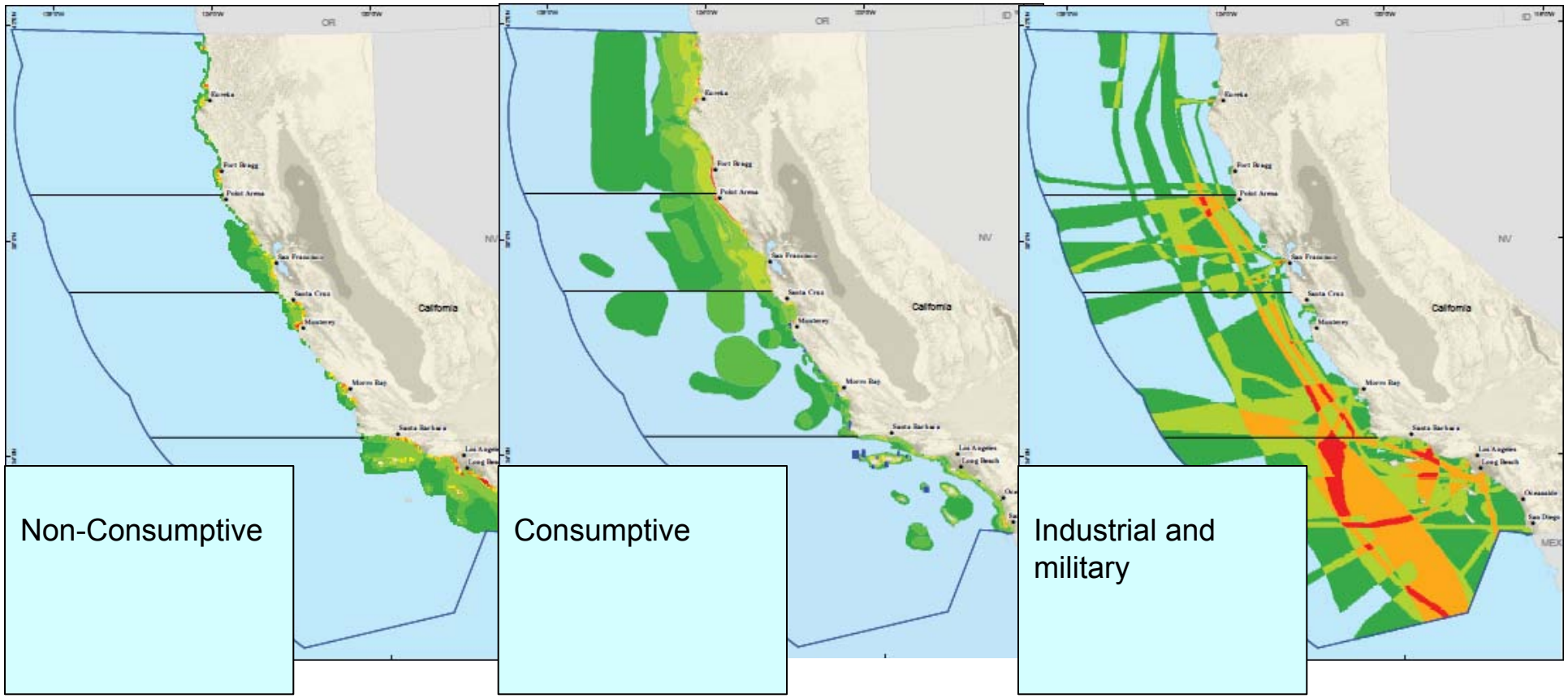
Next Step 2a: Threats assessment

Work with MCBI and National MPA Center to identify possible impacts to marine wildlife off California and U.S. West Coast.



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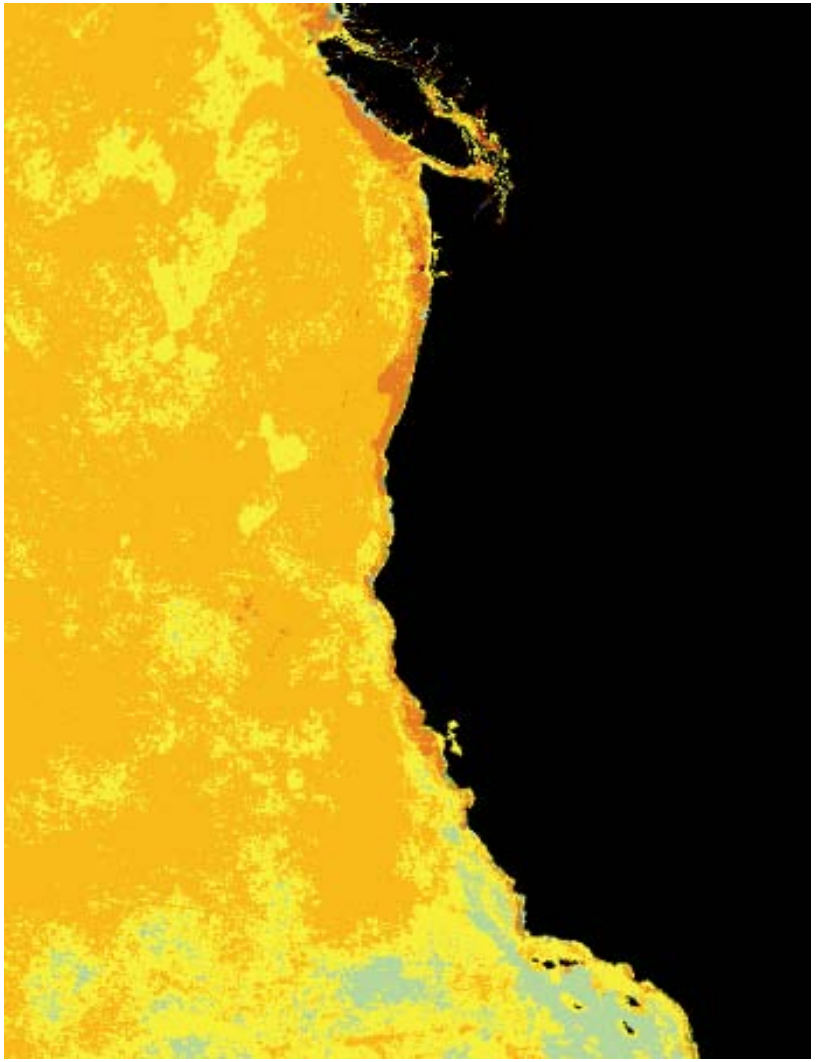
Next Step 2b: Human threats (25 activities)

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



Halpern et al. 2009

National Center for Ecological Analysis and Synthesis

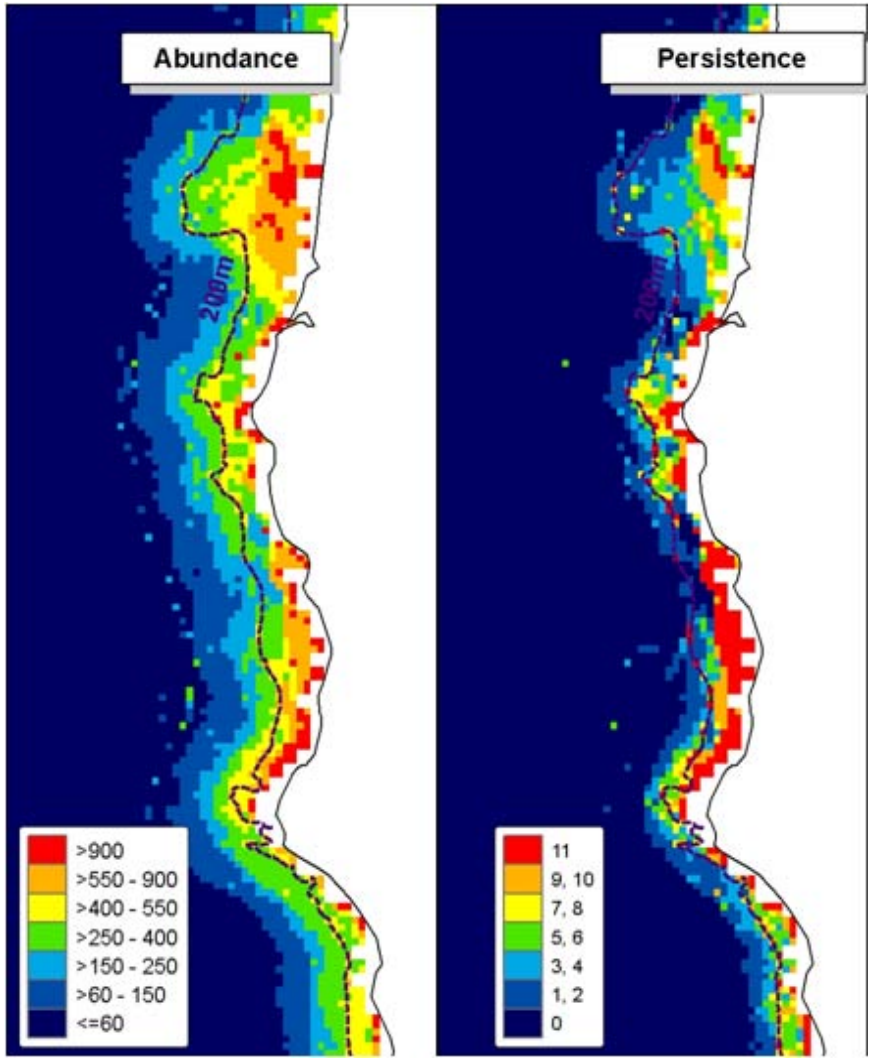
Next Step 3: Location and size of new NMS

Develop predictive models that focus on the Northern California to Southern Oregon region.

Information is important to support new sanctuaries:

1. Heceta Bank

2. Klamath and Eel river



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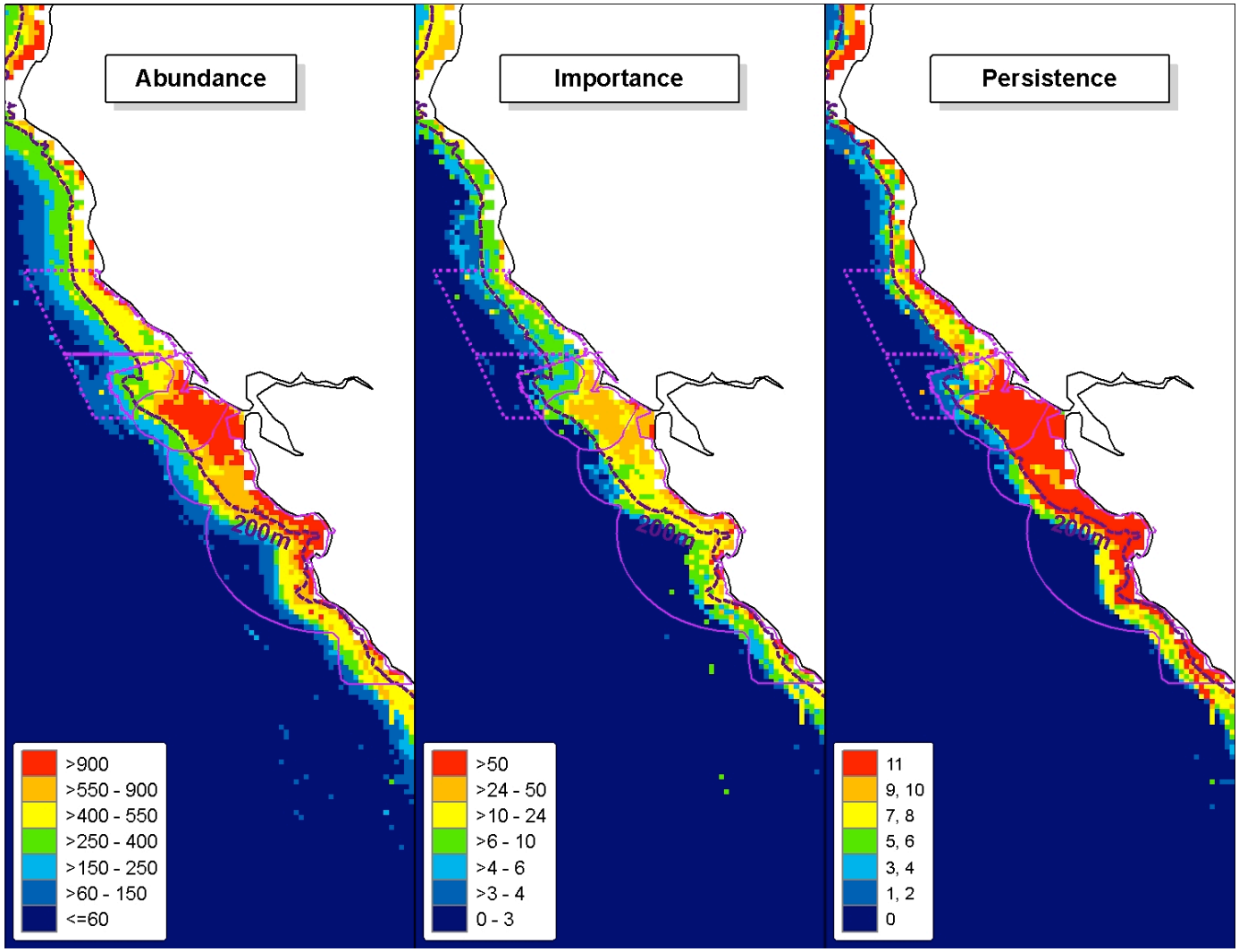
Gulf of the Farallones is a VERY important hotspot



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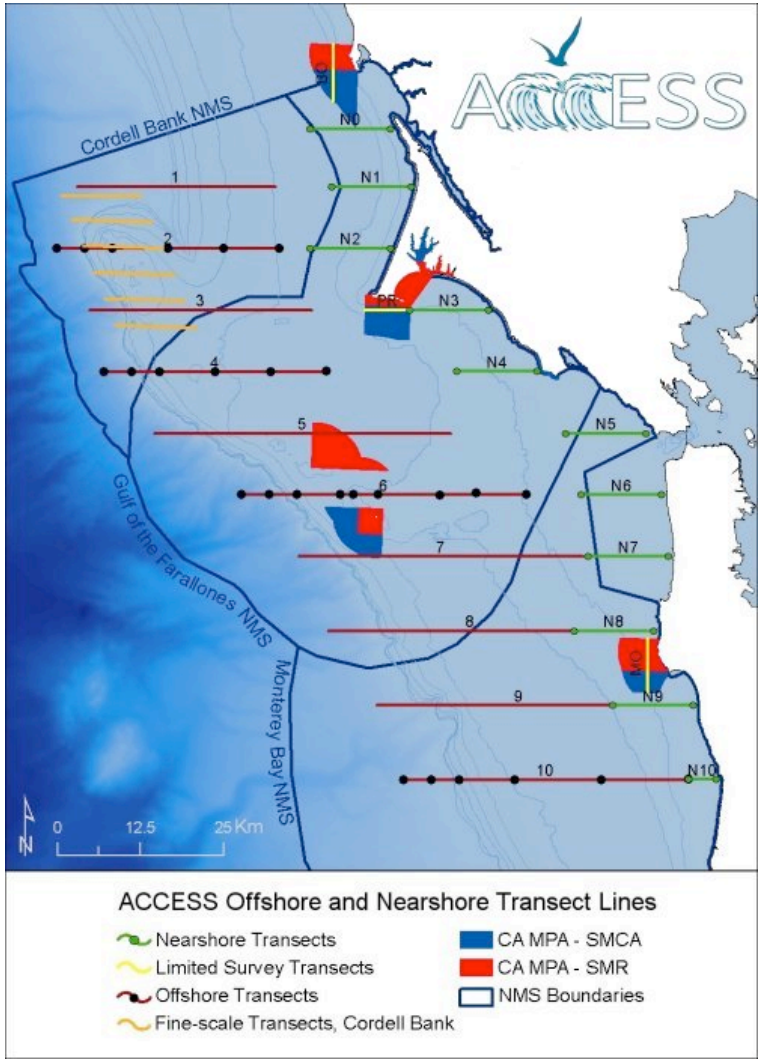
Applied California Current Ecosystem Studies

ACCESS Partnership

Conducting collaborative ocean research to inform resource managers, policy makers and conservation partners.

Founders:

Members:



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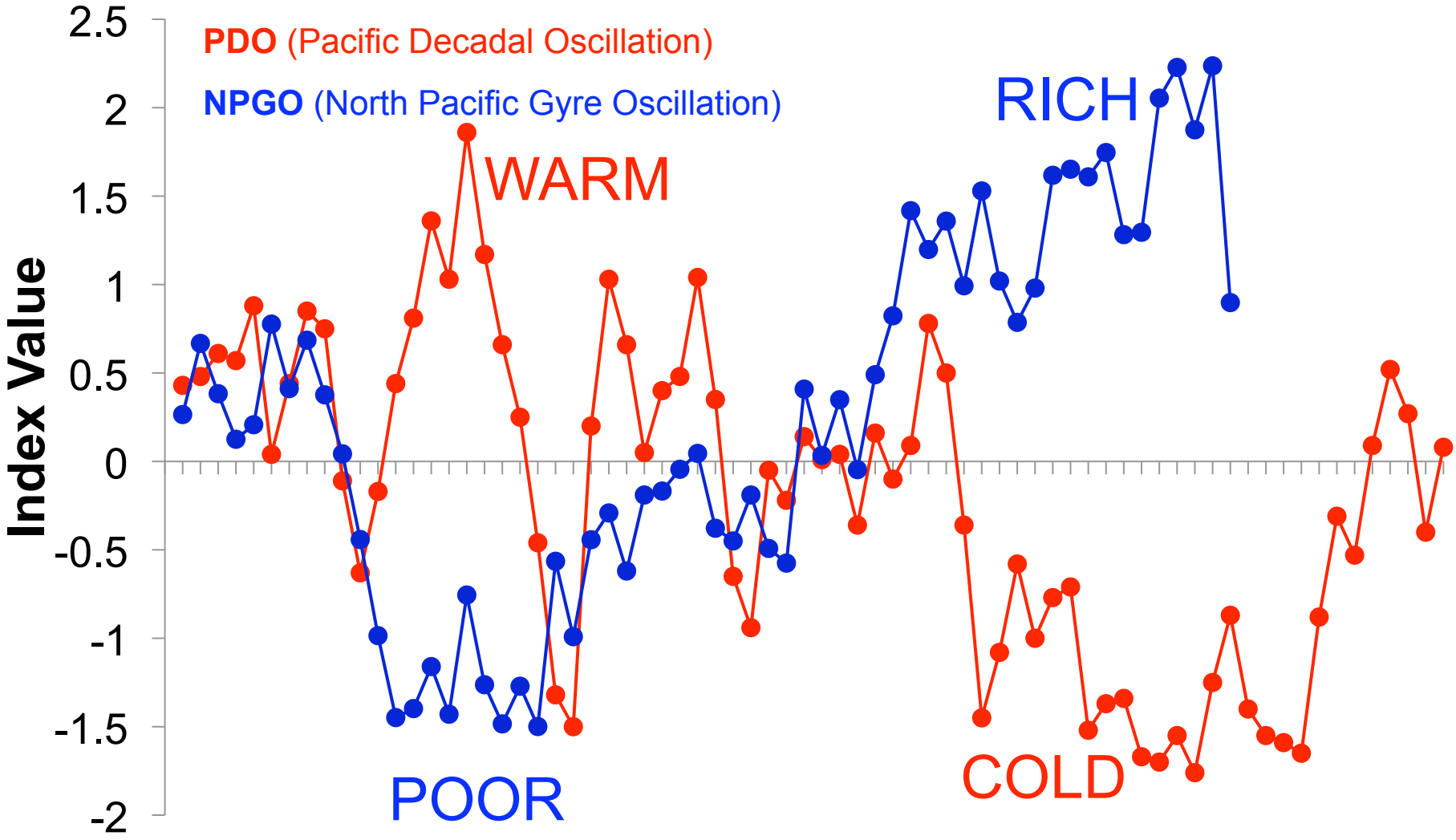
Extremely variable ocean conditions



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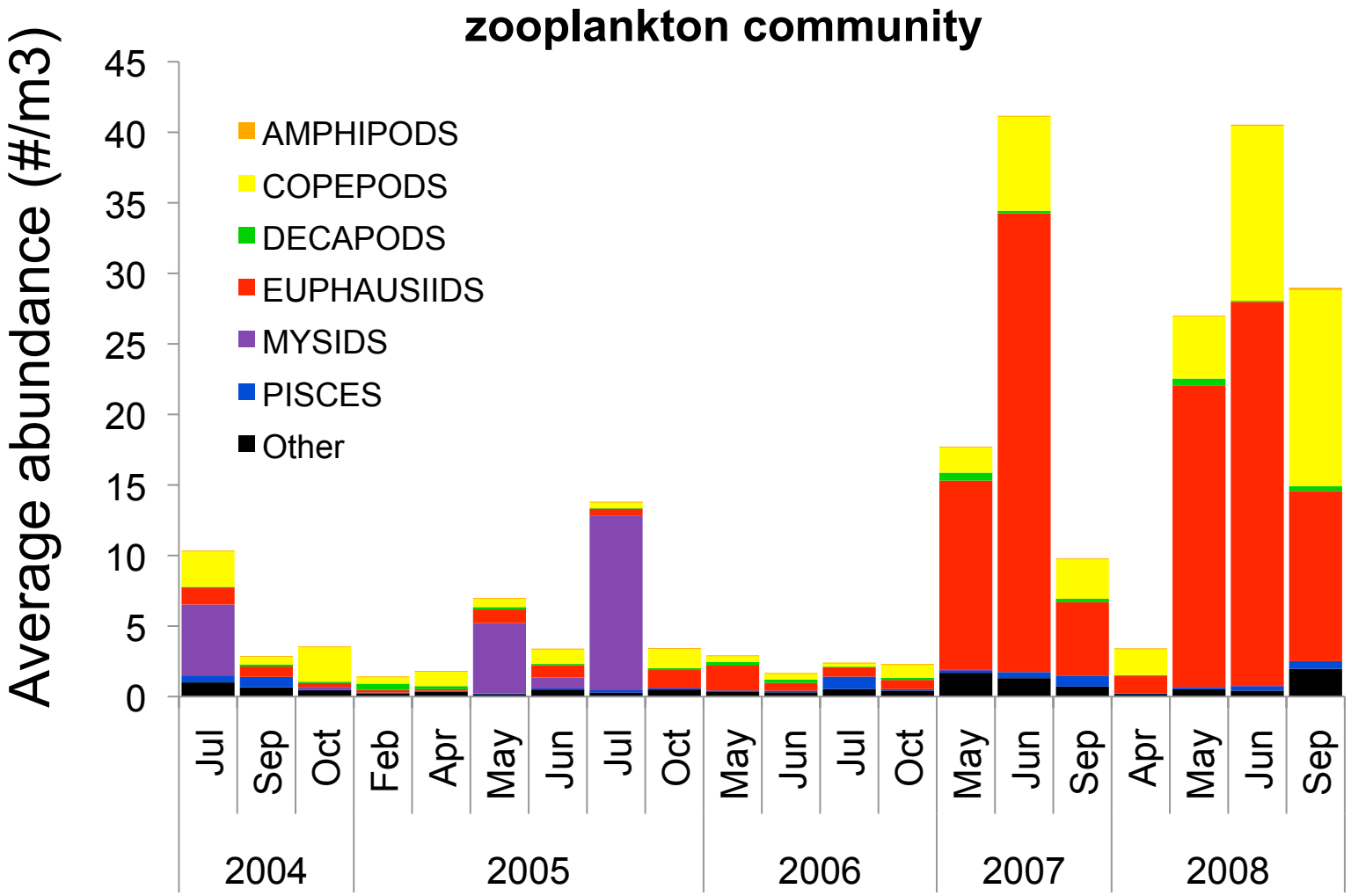
Extreme variability in prey available



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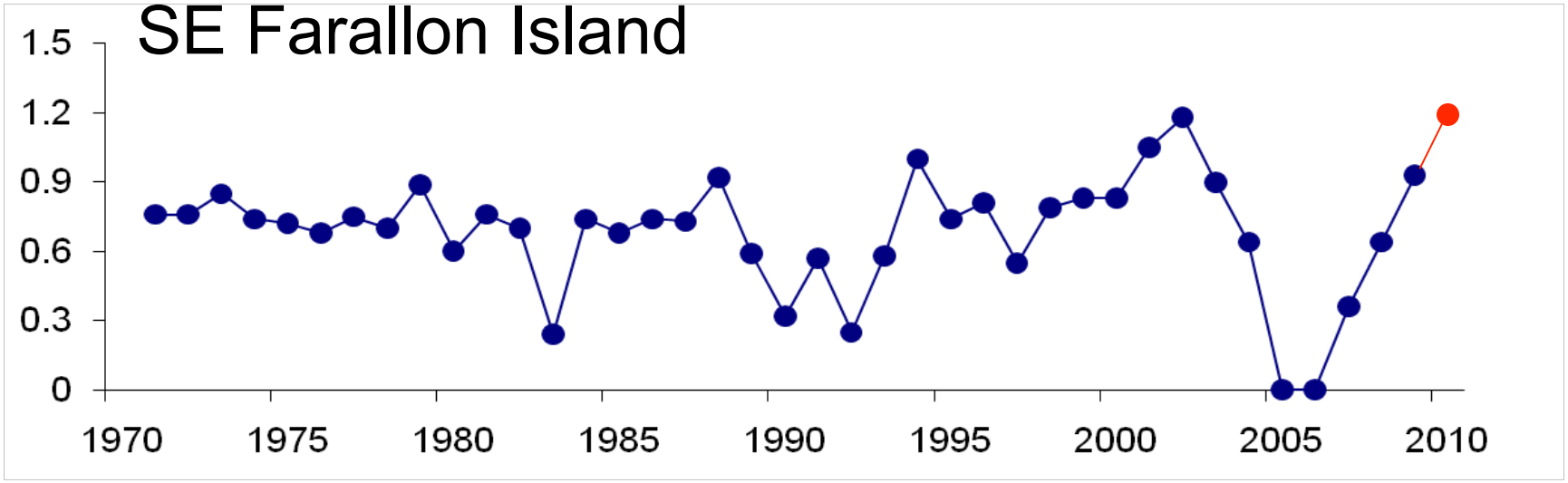
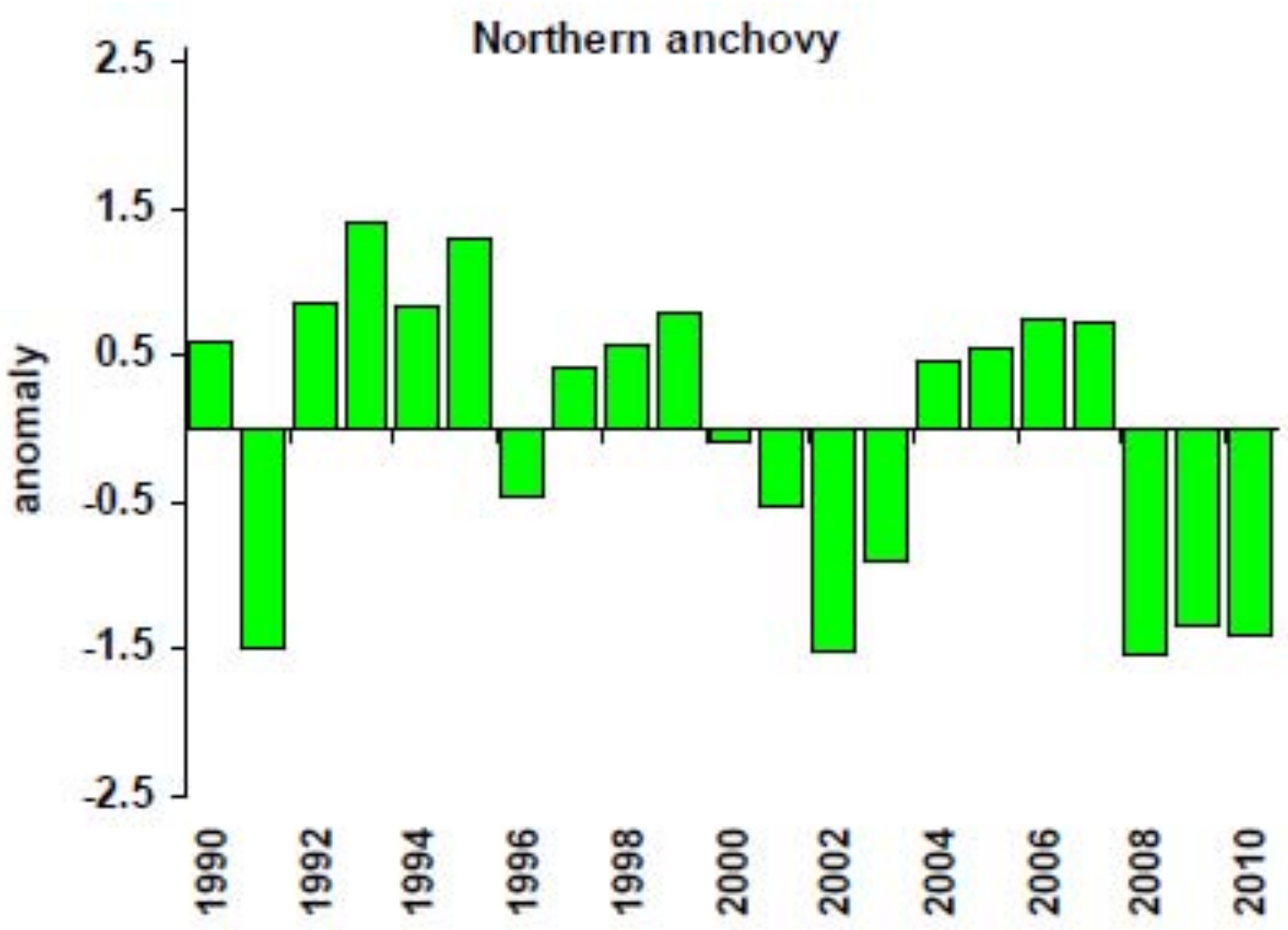
Cassin's auklet productivity



Very few anchovies in recent years



John Field, Steve Ralston and Keith Sakuma, Fisheries Ecology Division, SWFSC, NOAA

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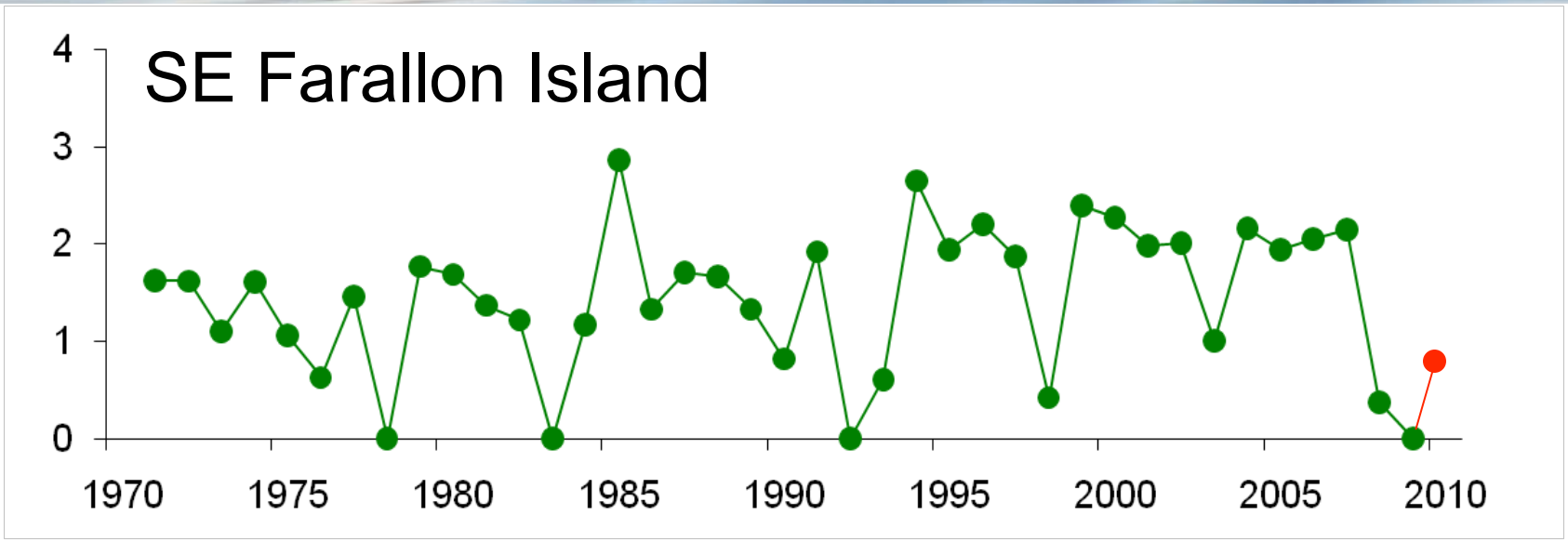
Brandt's cormorant productivity

© Jayson Mellom



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ACCESS partnership priorities

Wildlife – improve conservation of top predators and food webs,

Ocean zoning – guide human uses to protect the ocean,

Climate change – document change on the marine ecosystem,

Fish populations – contribute to ecosystem-based management,

Water quality – ecosystem effects of freshwater outflow.

Inform climate change adaptation

ACCESS will contribute to the climate change by:

- ❑ Advising the Sanctuary and Refuge on monitoring gaps
- ❑ Identifying threatened and vulnerable habitat
- ❑ Recommending best practices for monitoring and adaptation

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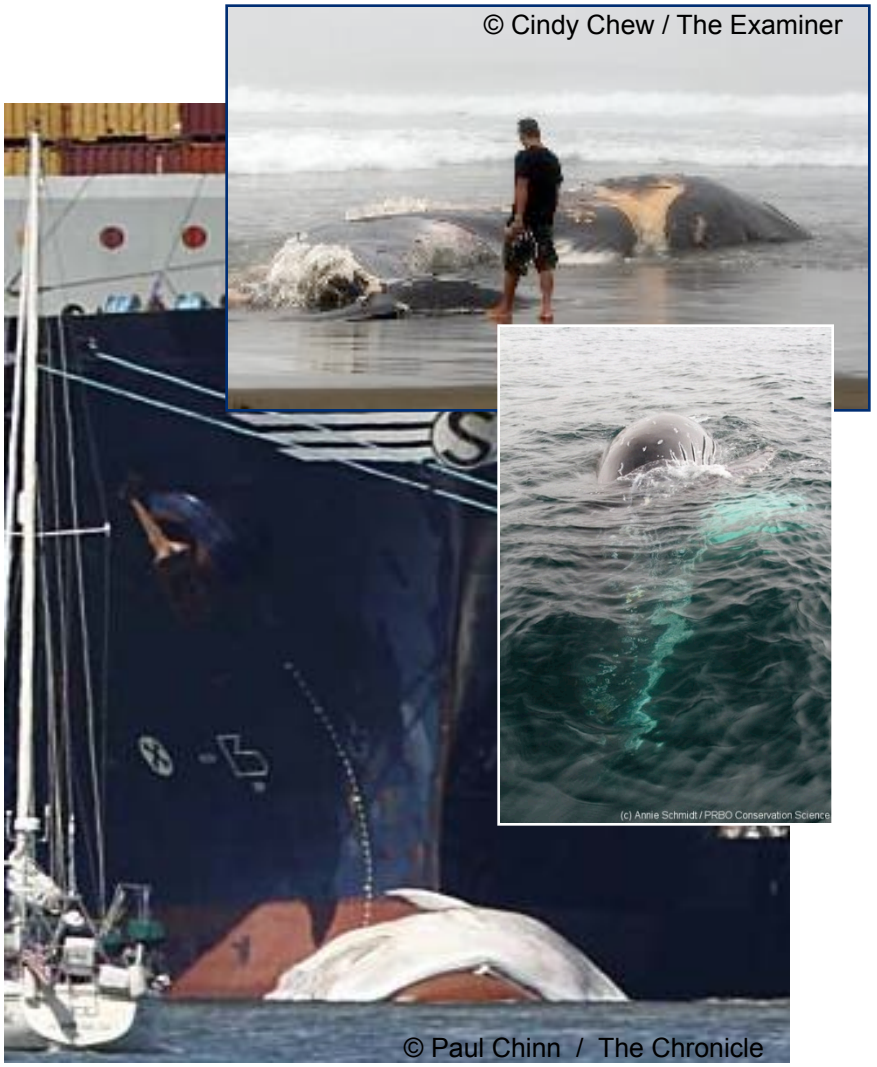
Inform ocean zoning

Shipping affects wildlife

- ❑ Directly through disturbance, noise, and strikes and
- ❑ Indirectly thorough water and air pollution

ACCESS can contribute to assess potential impacts and suggest recommendations to reduce these impacts.



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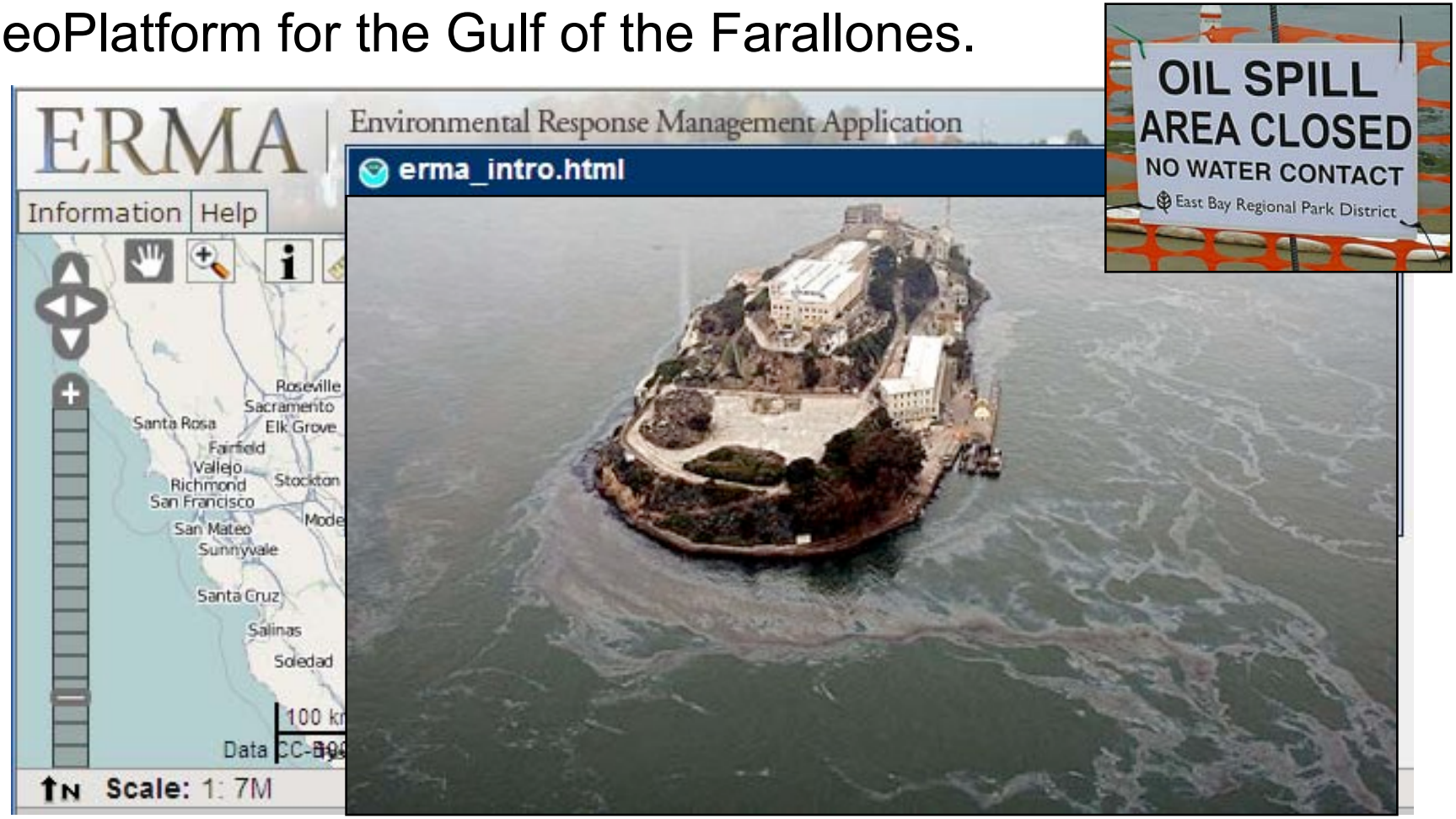
Inform emergency response

Contribute to develop a ERMA & GeoPlatform for the Gulf of the Farallones.



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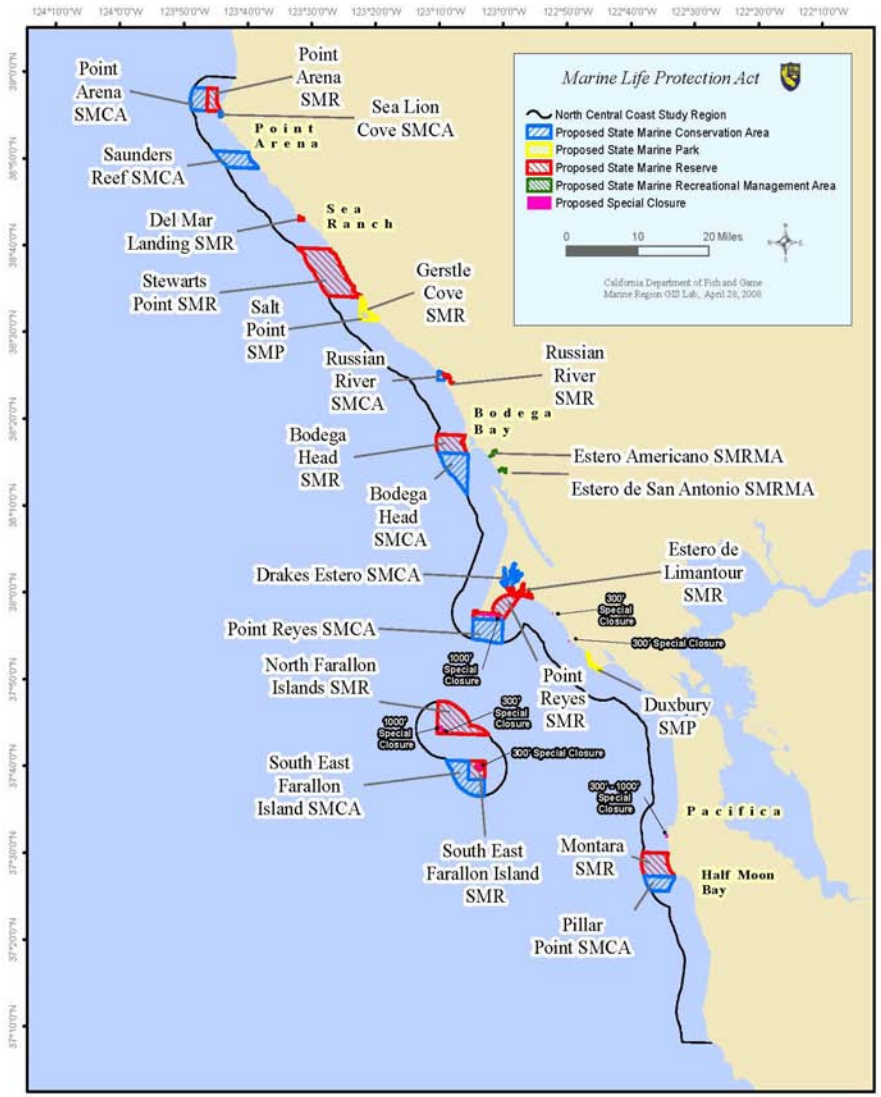
Inform MPA management by state

- ACCESS monitoring takes an ecosystem approach.
- ACCESS provides a regional context to more localized monitoring efforts by the state.



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Inform HAB monitoring by state

- ACCESS provides a regional information to
- understand the extent of the bloom and
- the oceanographic conditions that may have led to the bloom

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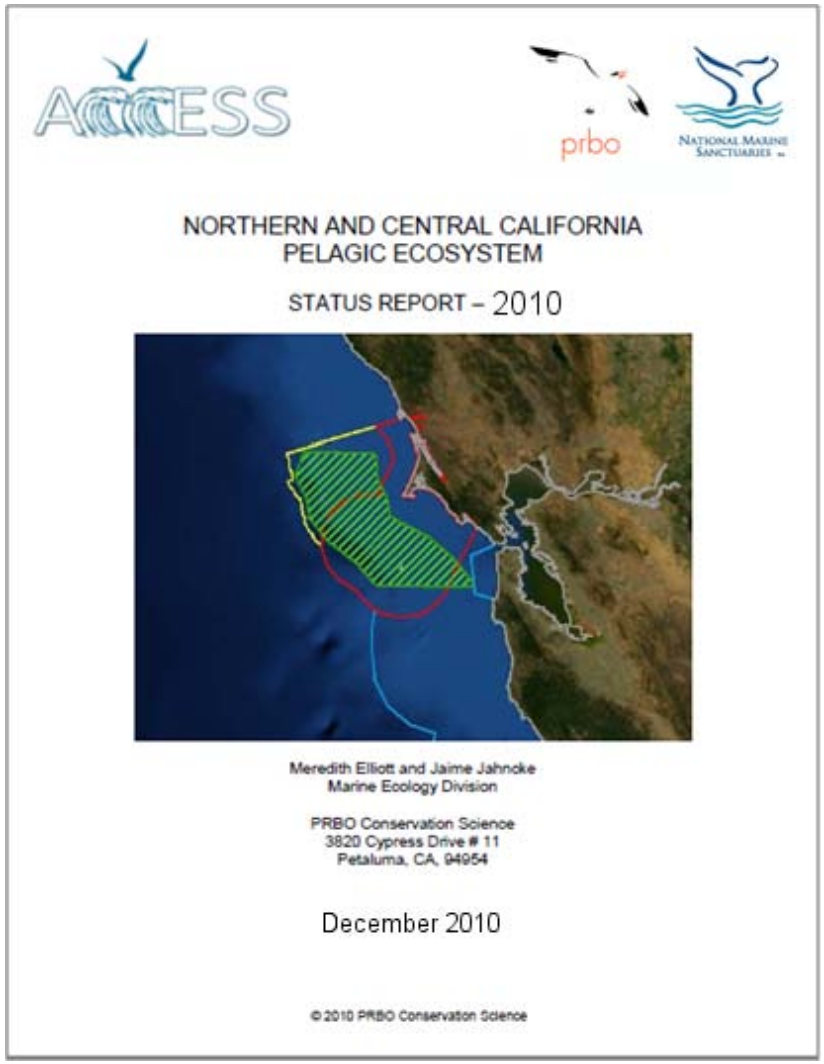
Communicate findings to partners

Summarizes information on:

- Climate
- Oceanography
- Nutrients (OA)
- Primary production
- Zooplankton
- Fish (forage fish/ fisheries)
- Birds (at-sea/colonies)
- Mammals (at-sea/rookeries)

Recent data in the context of available historical data



Leader EBM in Bay Area

- Become member of West Coast Ecosystem-Based Management Network
- Focuses on identifying, utilizing, and promoting the most effective mechanisms to implement ecosystem-based management approaches in coastal communities on the West Coast.

Undergraduate training and research

Sonoma State Students

Junior/Senior year students – working with Karina Nielsen

Katherine Dodge-Taylor (2010)
Katie Vedder (2010)
Stephanie Parreira (2010)
Carinn Skarry (2010)
Amanda Van Diggelen (2010)

Pomona College Students

Junior/Senior year students – working with Nina Karnovsky

Kristina McOmber (2010)
Eleanor Caves (2009)
Charlotte Chang (2008)
Derek Young (2008)

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Graduate student research (Doctorate degree)

Rachel Fontana, PhD Candidate, UC Davis (Largier)
Oceanographic frontal features within the northern California shelf region: patterns, predictability, and biological importance

Ben Saenz, PhD Candidate, Stanford University (Arrigo)
Interplay of advection and food availability in the structuring of krill populations in the Gulf of the Farallones

Very likely…

Julia Burrows, PhD Student, Duke University ()
Fine scale foraging ecology of humpback whales and blue whales in Central California National Marine Sanctuaries

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Graduate student research (Masters degree)

Pam Michael, MSc Candidate, Hawaii Pacific University (Hyrenbach)
Modeling the dispersion and habitat associations of Black-footed Albatross in Central California National Marine Sanctuaries

Shannon Lyday, MSc Student, Hawaii Pacific University (Hyrenbach)
Pink-footed shearwater distribution and abundance along the coast of North America with emphasis in Central California National Marine Sanctuaries

Andrea Dransfield, MSc Student, San Francisco State (Hines)
Humback whale habitat association in Central California National Marine Sanctuaries

Potential new MSc student with Toby Garfield, SFSU

Acknowledgments

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

Farallon National Wildlife Refuge (USFWS)

Cordell Bank National Marine Sanctuary (NOAA)
Gulf of the Farallones National Marine Sanctuary (NOAA)

Farallones Marine Sanctuary Association

PRBO Staff, Interns and Volunteers

ACCESS - Windows Internet Explorer

http://www.accessoceans.org/

Google

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Los Farallones

Live Webcam

Home

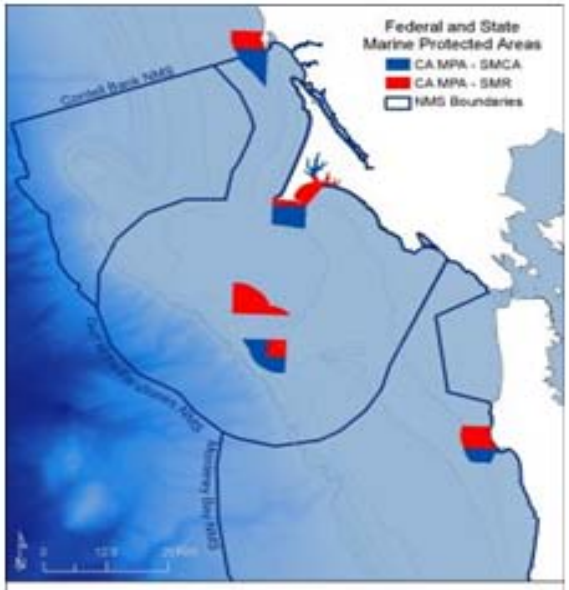
ACCESS is a partnership that supports marine wildlife conservation and healthy marine ecosystems in northern and central California by conducting ocean research to inform resource managers, policy makers and conservation partners.

Effective management and conservation of natural resources requires adaptive management strategies that are informed by robust analysis of past and present data and information at an ecosystem scale.

ACCESS focuses on the oceanic habitats in Federal and State waters of northern and central California, encompassing NOAA – National Marine Sanctuary waters (Cordell Bank, Gulf of the Farallones and Monterey Bay) and the potential National Marine Sanctuary expansion area south of Point Arena.

ACCESS was formed by **PRBO Conservation Science**, **Cordell Bank National Marine Sanctuary**, and **Gulf of the Farallones National Marine Sanctuary**.

Download a 1-page description of our project.



Click here to download a full size map of the study area showing transect lines and oceanographic stations.