Pacific Continental Shelf Environmental Assessment (PaCSEA): Seabirds and marine mammals off northern CA, OR, and WA

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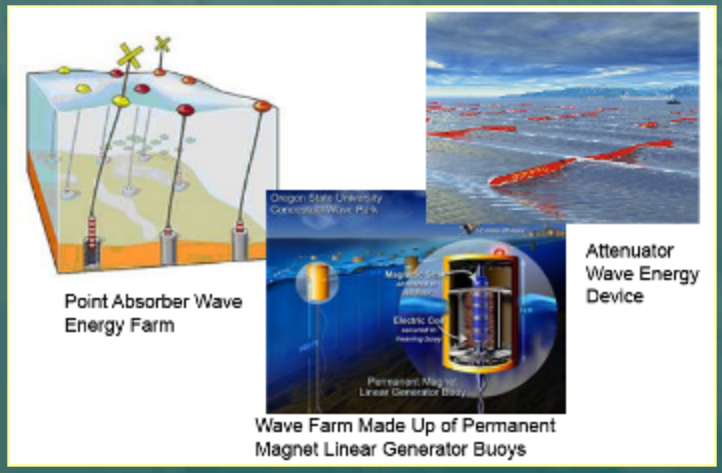
Goal: Ecological information to advise alternative energy planning

- National Environmental Policy Act (1969) requires interdisciplinary approach for planning
- Energy Policy Act (2005) amended to include alternative energy leasing throughout OCS
- BOEM Environmental Studies Program supports *up-to-date* environmental information required for NEPA assessments, protection of Marine Mammals (MMPA 1972) and taxa listed under the (ESA 1973)



Seabirds depend on wind and wave energy!

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Valid risk assumed for seabirds

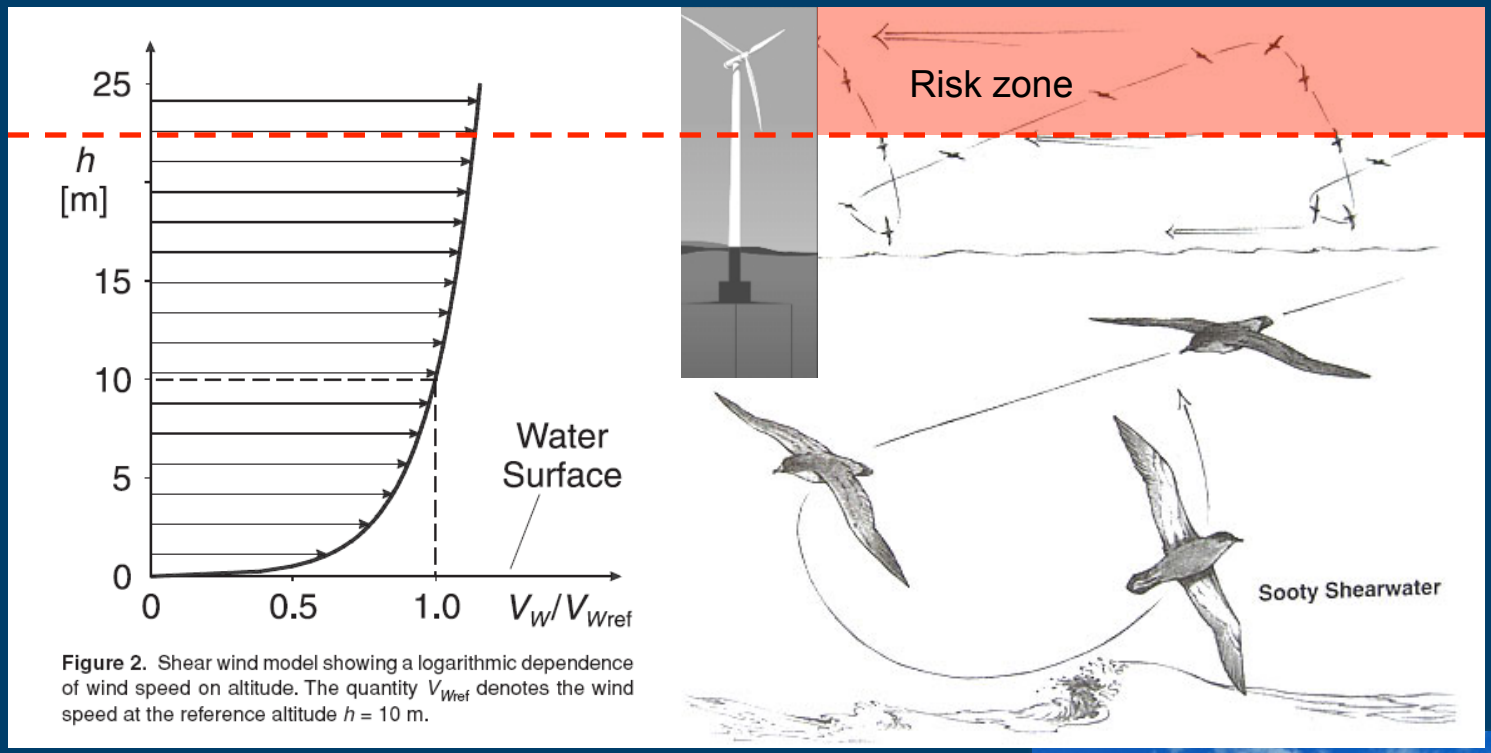

Figure 2. Shear wind model showing a logarithmic dependence of wind speed on altitude. The quantity V_{Wref} denotes the wind speed at the reference altitude h = 10 m.

- Species-specific flight behavior is function of winds and waves
  - ✓ e.g., dynamic, gust, and sail-soaring among albatrosses and petrels

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Rayleigh 1883, Sachs 2005, Pennycuick 2002

Data Gaps for Marine Birds (Oregon)

C.f., Suryan et al. unpublished report

- Nonbreeding season (fall/winter/spring) distribution and abundance
- Summer distribution and abundance south of Newport, OR
- Migration paths and area use (residence time) from tracking
- Refined estimates and additional monitoring of burrow-nesting seabirds (e.g., Cassin's Auklet, Rhinoceros Auklet, storm-petrels)
- Flight altitude
- Numerical models to evaluate collision risk, fitness costs, and population level impacts

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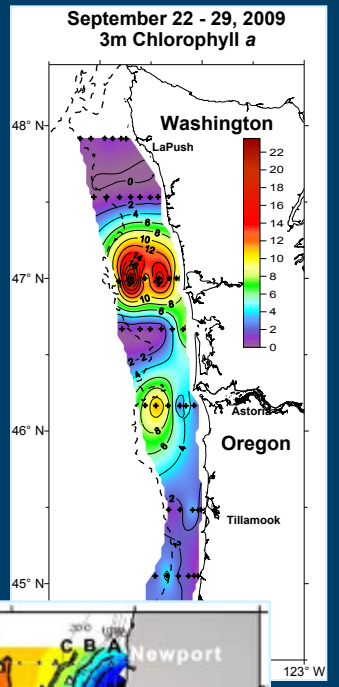
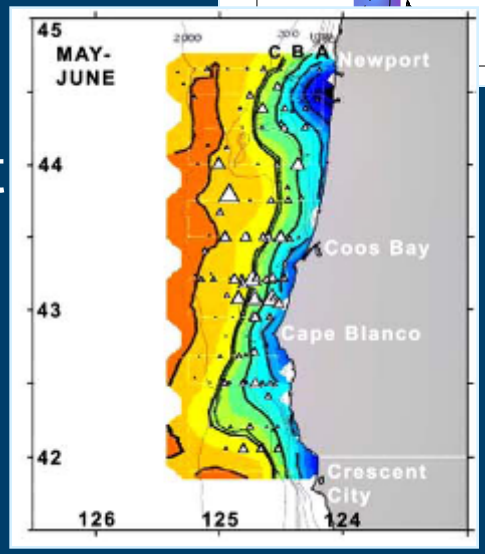
See Report: **Marine bird colony and at-sea distributions along the Oregon coast: Implications for marine spatial planning and information gap analysis**. Robert M. Suryan, Elizabeth M. Phillips, Khemarith So, Jeannette E. Zamon, Roy W. Lowe, Shawn W. Stephensen

Regionally important biological areas

- Columbia River Plume
  - NOAA-OSU fisheries oceanography cruises (since 1998)
- Heceta Bank / Cape Blanco
  - GLOBEC-NE Pac Program (2000)
- Large Seabird Colonies
  - Varoujean & Pitman 1980, Naughton et al. 2007
  - 1.3 million nesting seabirds representing 15 species (53% COMU, 37% LHSP)





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Ainley et al. 2005; NOAA NWFSC *unpubl. data*

PaCSEA objectives

1. Conduct aerial at seas surveys for seabirds, marine, mammals, and turtles in coastal shelf waters off CA, OR, and WA
2. Summarize population densities, community composition, and conduct comparison with previous survey results (1980-83, 1989-90)
3. Validate and enhance aerial survey data for numerically abundant species and important breeding and migratory species through existing and supplementary telemetry
   - e.g., Common Murre, Shearwaters, Black-footed Albatrosses

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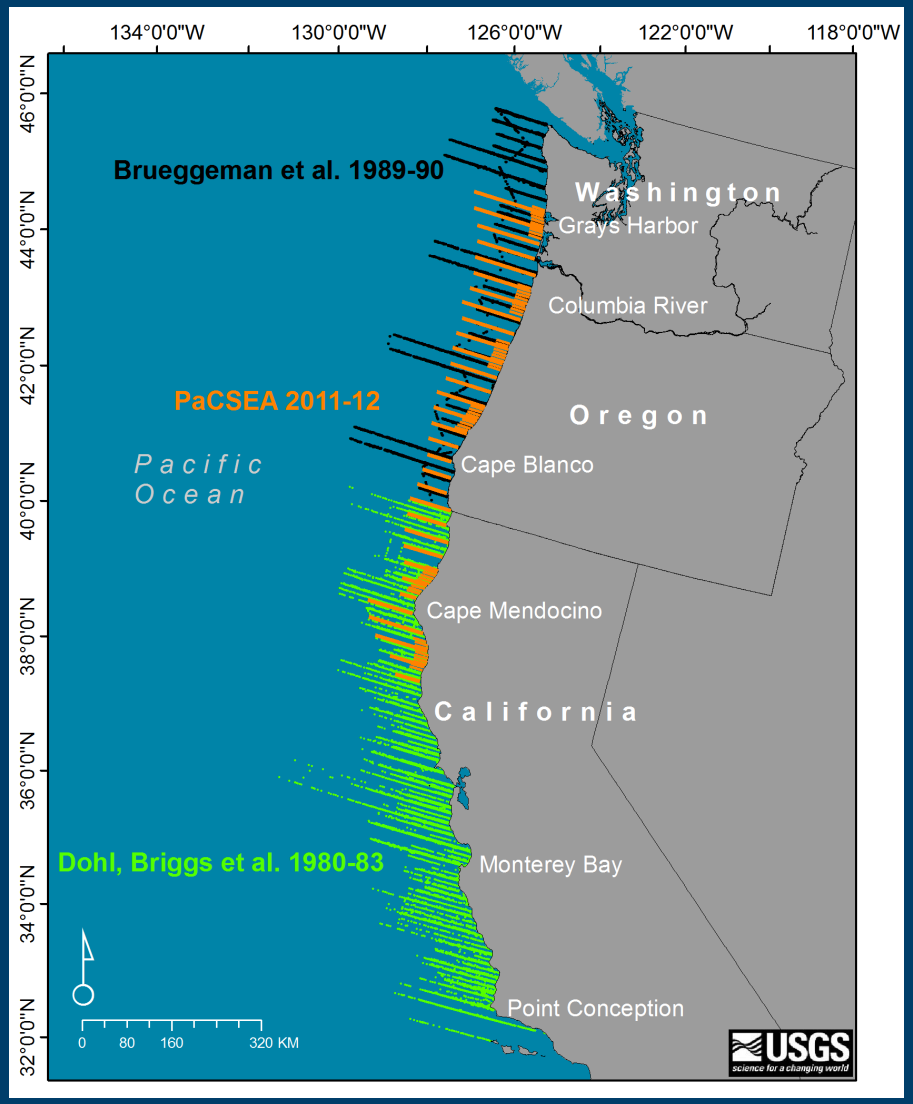
Aerial survey history:

Brueggeman et al. 1992 & Dohl, Briggs et al. 1983

- 12 surveys: Apr. 1989 – Sept. 1990 (4 “solar” seasons)
- OR and WA coastline
- 40,013 km systematic surveys
  - 42 spp. seabirds (shearwaters, murres, storm-petrels, gulls, phalaropes)
  - 14 spp. cetaceans (94% Odontoceti)
  - 97% mammals (6 spp.) grey whale, humpback whale, Pac. White-sided dolphin, Risso’s dolphin, harbor porpoise, northern right whale dolphin
  - 5 spp. pinnipeds
- Recommended: future surveys allocate effort in Fall and Winter



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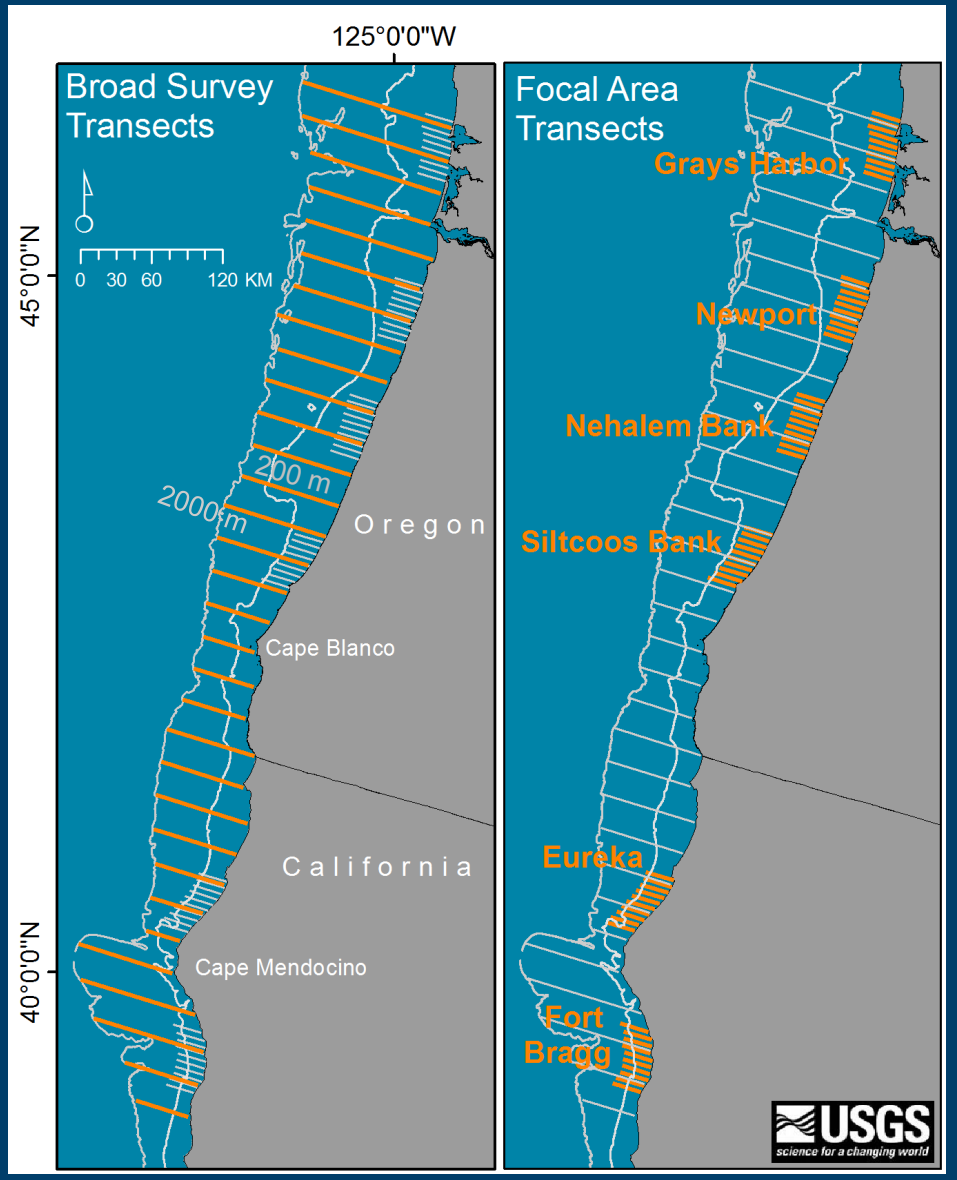
PaCSEA design

- 2 survey years: 2011, 2012
- 3 oceanographic seasons (Winter, Upwelling, Davidson)
- Fort Bragg, CA to Grays Harbor, WA
- Uniform broad-scale transects: *N* = 32, 28-km spacing, span continental shelf/slope (45-130 km length)
- All marine birds, mammals, turtles, vessels, features
- Systematic survey effort comparable to Breuggeman *et al.* 1992, but excludes OCNMS, includes northern CA



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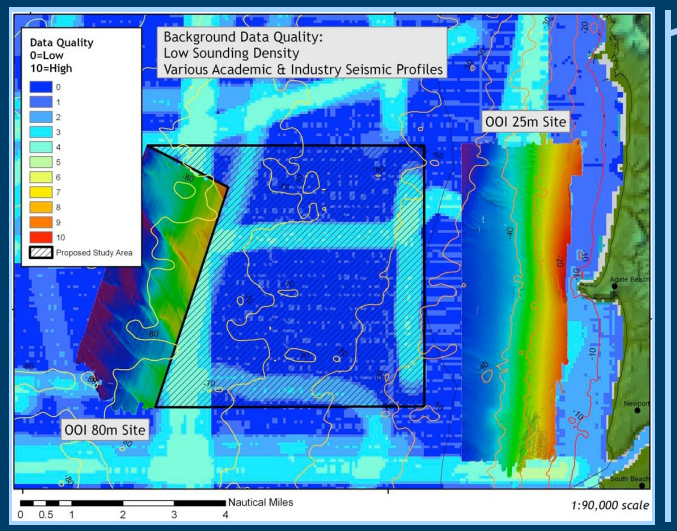
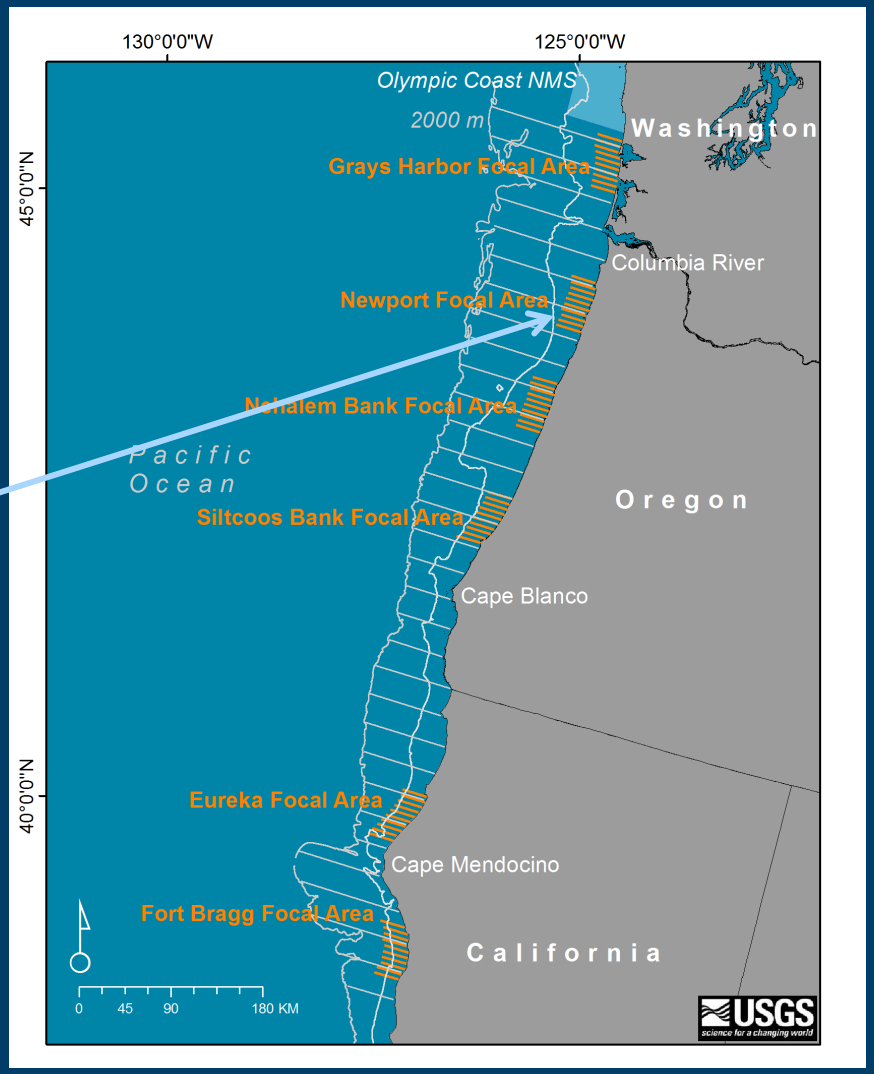
Nested focal areas overlap with fine-scale, nearshore, benthic survey areas (OSU CDFA)

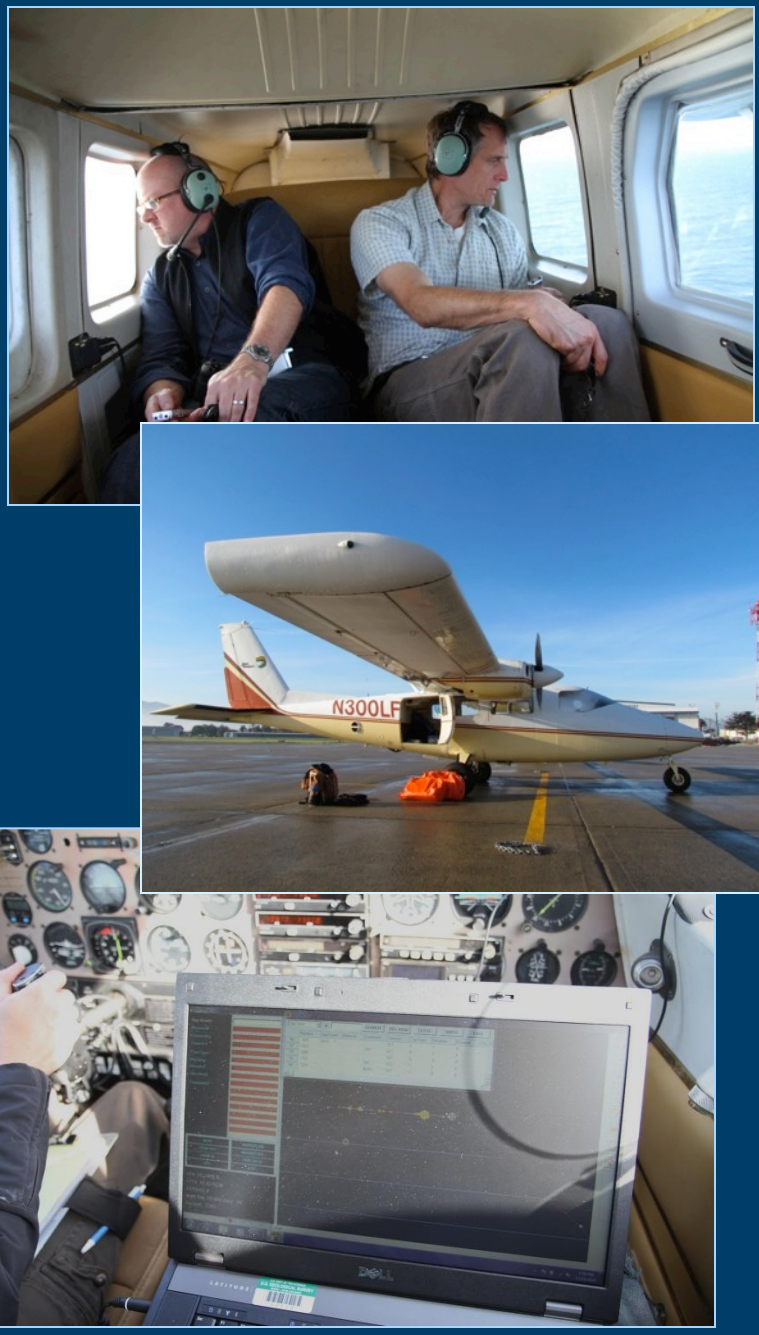
- Focal areas provide local-scale context for community assemblages associated with 6 targeted benthic areas identified by BOEM
- 10× 25 km-transects each, 5.6 km spacing





Survey methods

- Aerial strip transects (Briggs *et al*. 1985, Mason *et al*. 2007)
- 61-m ASL, 160 km hr^{-1}
- 2 dedicated observers, 75-m strips adjacent to track-line
- Co-pilot observer for incidental sightings, data acquisition, navigation
- Species ID to lowest taxon, recorded digitally, archived, transcribed, and cross-checked
- 2 airborne sensors: IR pyrometer (SST), HOBILabs HydroRad-3, full-spectra-radiometer (ocean color)



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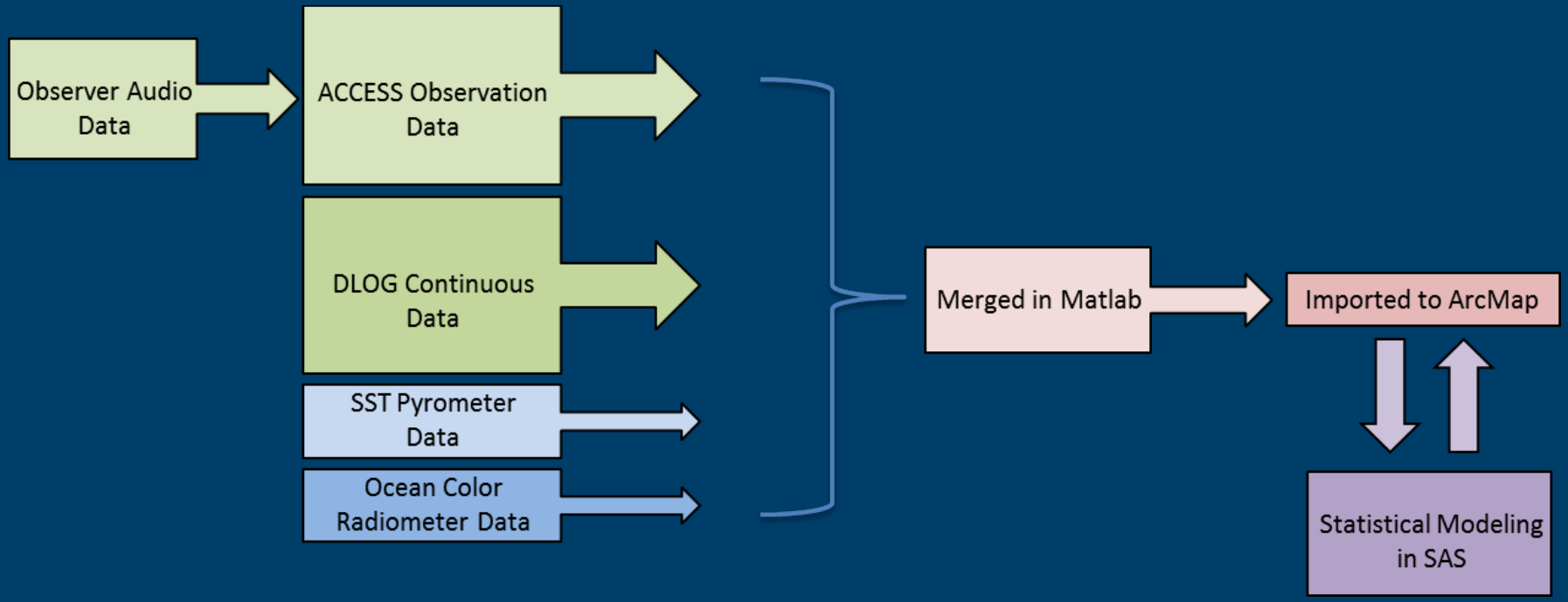
Data acquisition and processing



- Multiple custom programs in ArcGIS, Matlab
- Working toward broad applicability to handle additional data sets (i.e., for rescaling density estimates, facilitate comparisons between studies)

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Preliminary Results

- Completed replicated Winter, Summer, Fall surveys (2011-12)
- ~27,000 km transect effort (broad-scale and nested, fine-scale surveys)
- 50 marine bird species, 15 marine mammal species (does not include incidental sightings), other marine life, vessels, debris, and fishing gear

Photos: Jon Felis, USGS

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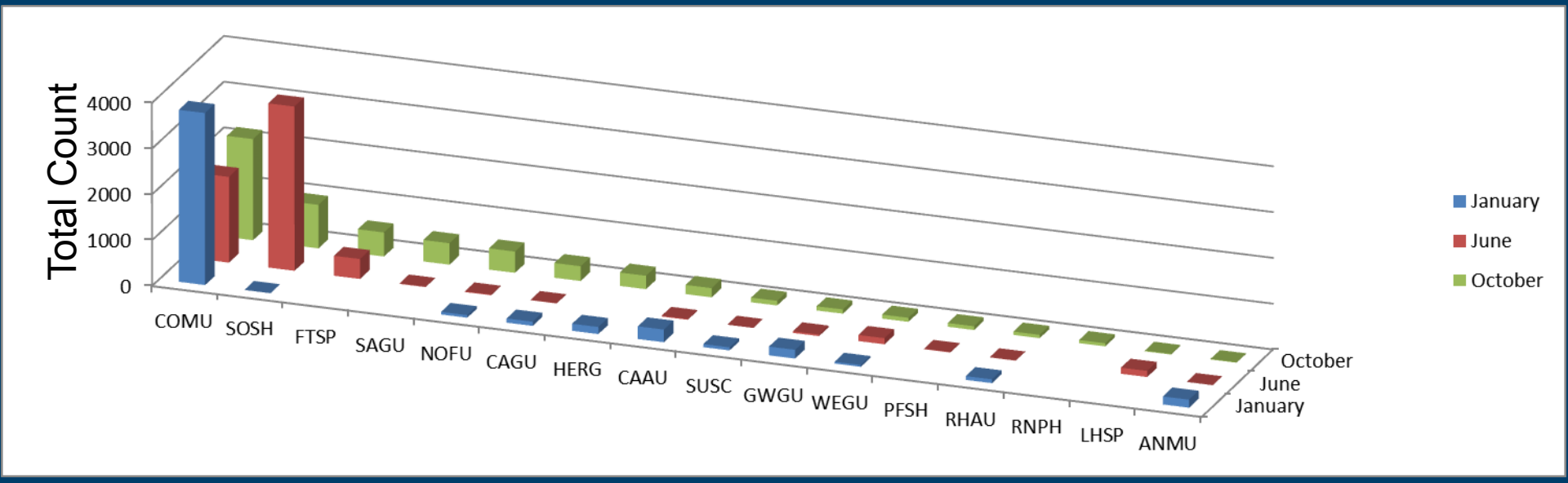
Broad survey summary : %N 2011

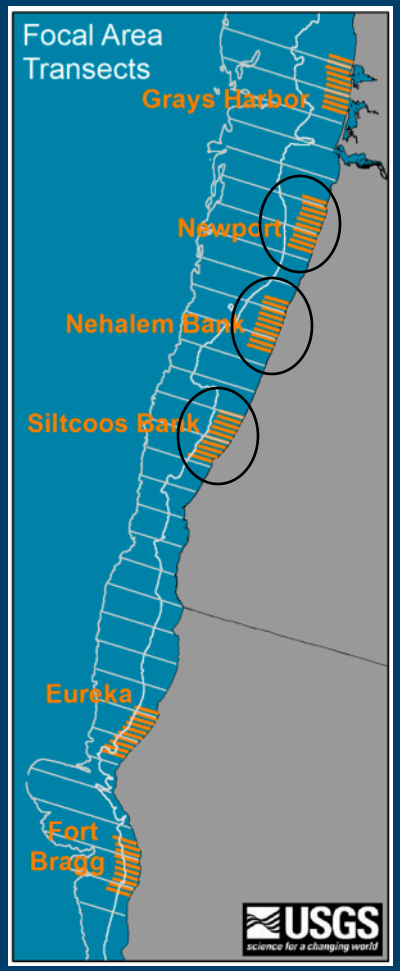
- Jan: 27 spp. 96%N – 10 species: 73% COMU, 5% CAAU, 4% GWGU, 3% ANMU
- June: 24 spp. 97%N – 5 species: 57% SOSH, 30% COMU, 7% FTSP, 2% WEGU, 2% LHSP
- October: 37 spp. 95%N – 16 species: 33%COMU, 14% SOSH, 8% FTSP, 7% SAGU, 7% NOFU, 5% CAGU

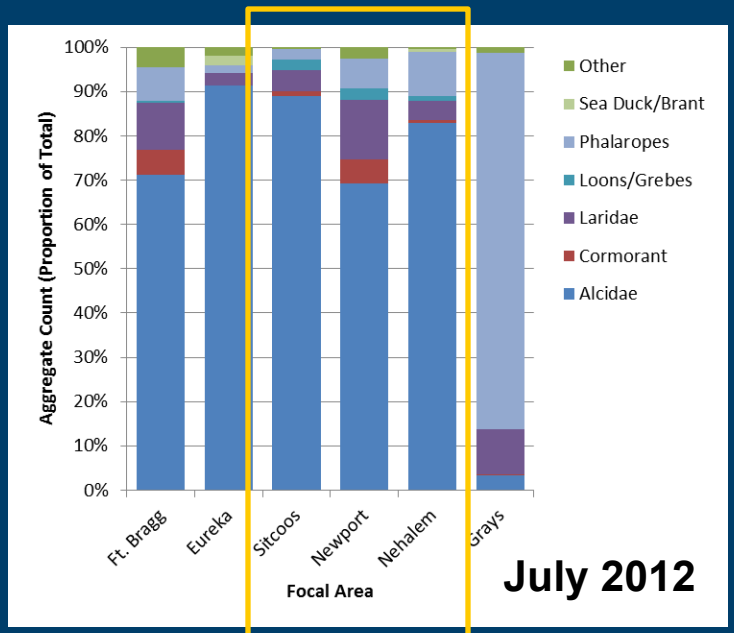


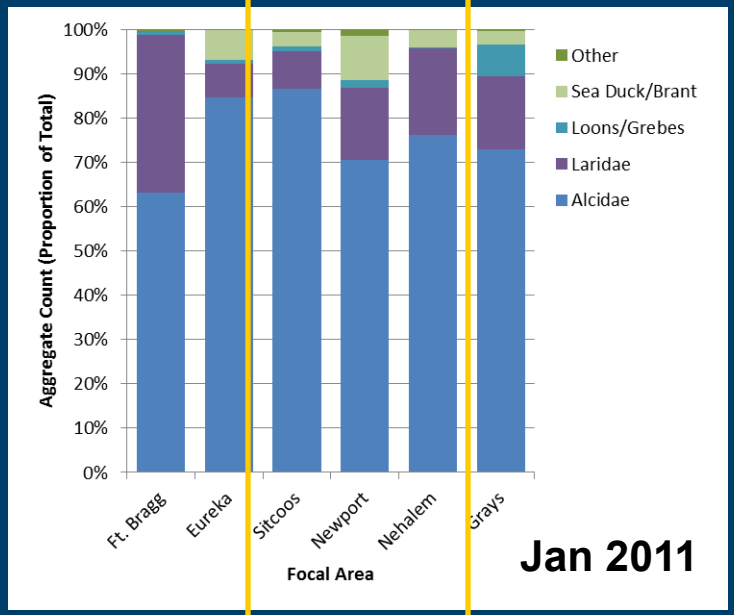
Focal area summaries: %N

Oregon Focal Areas

- ~1500 km trackline per month (6 areas), finer resolution inner shelf and site-specific patterns
- Alcidae dominate (murres followed by gulls)
- Newport has greatest diversity (cormorants in summer, sea ducks in winter)







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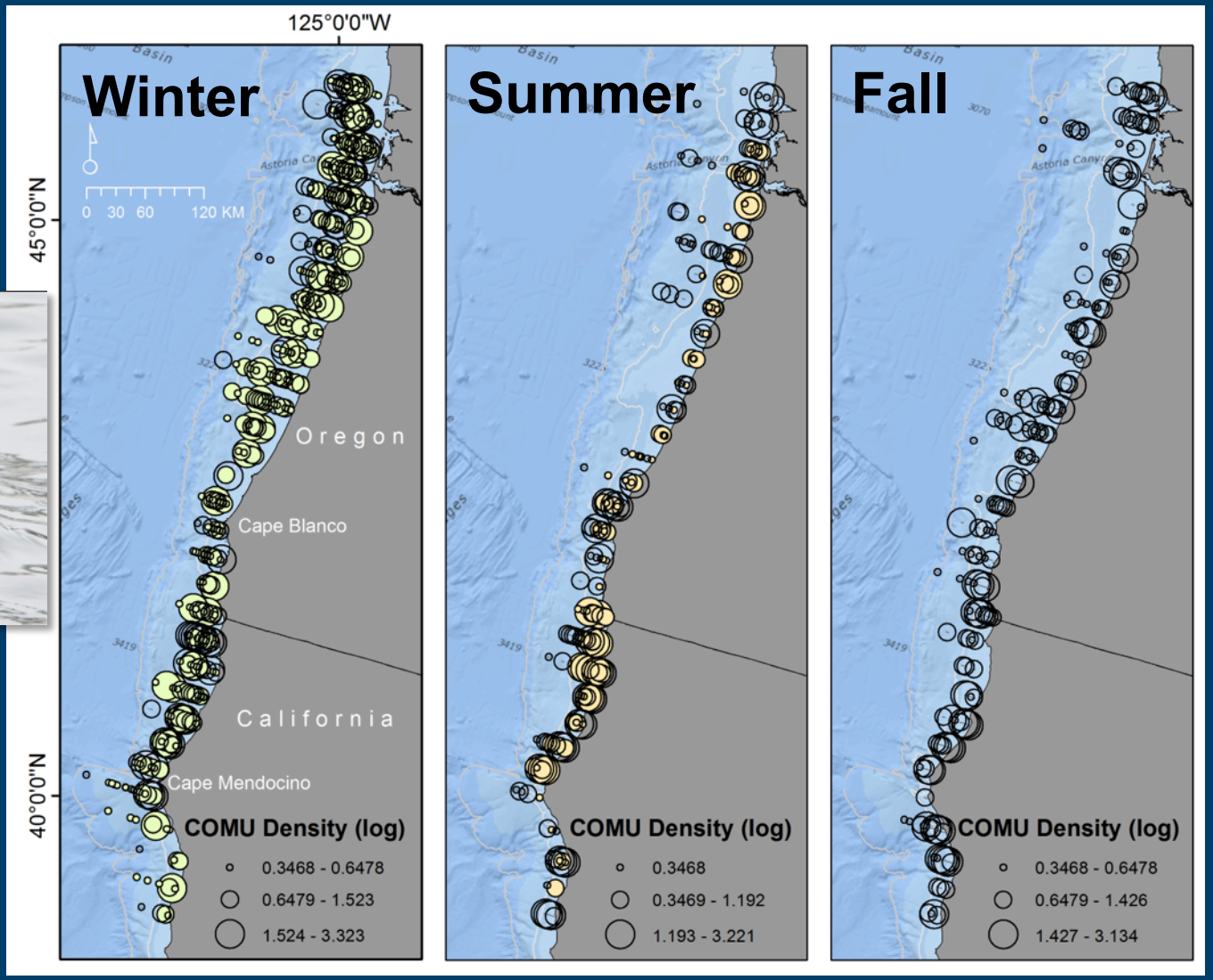
Common Murre (30 – 73%N)



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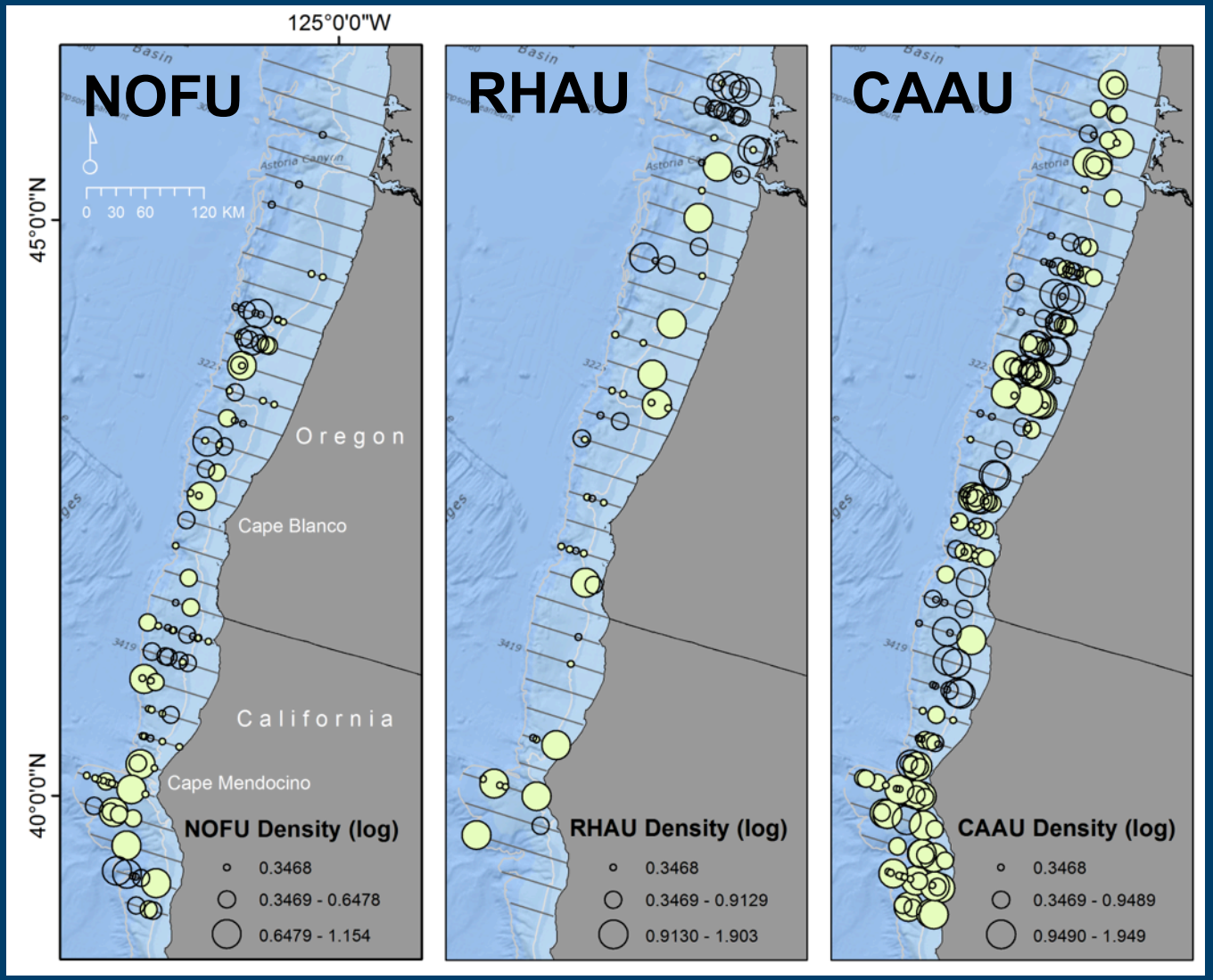
Open circles = 2011; filled circles = 2012

Additional abundant wintering species

Photo Jeff Poklen

Photo sfu.ca

Photo Jeff Poklen



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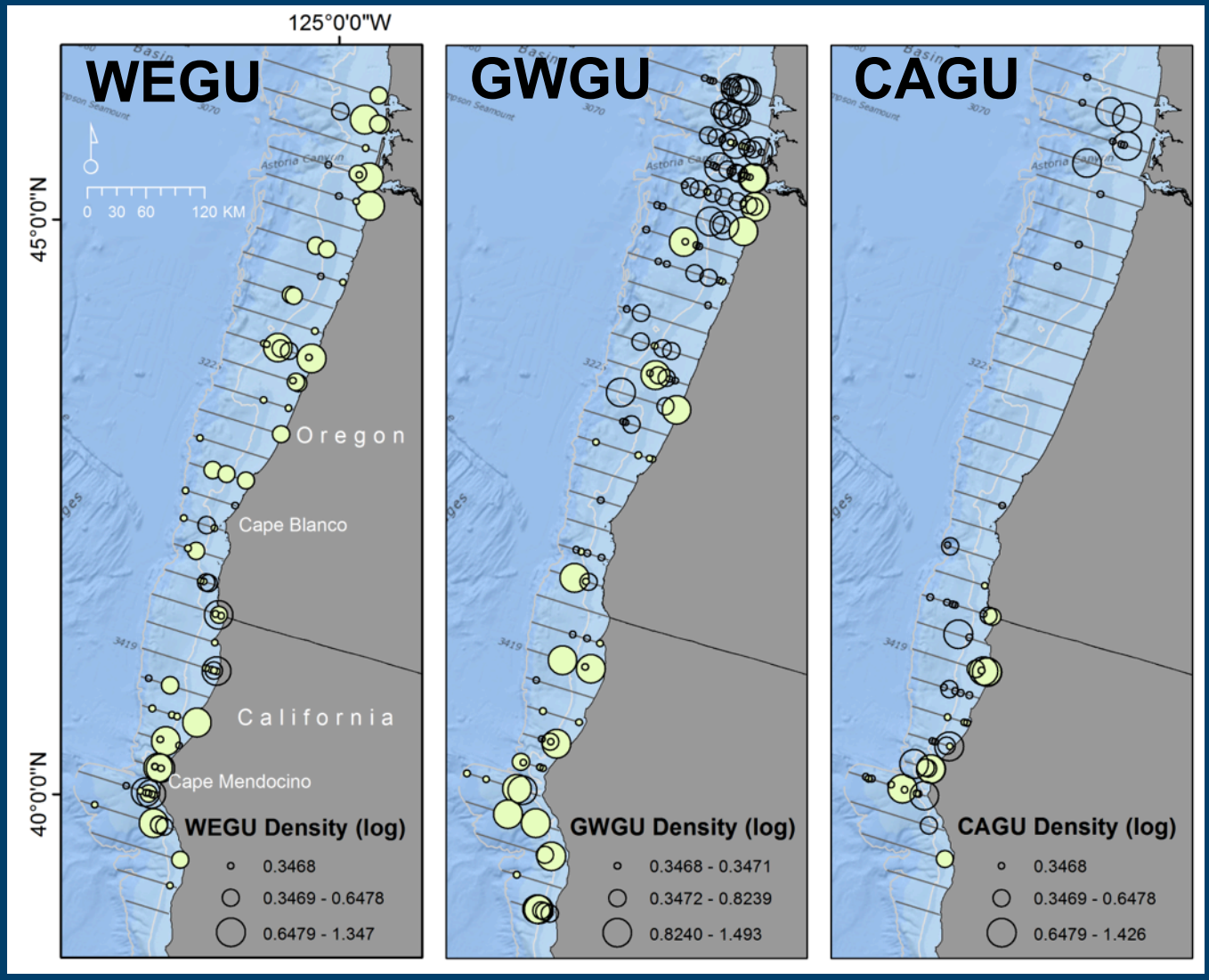
Open circles = 2011; filled circles = 2012

Abundant wintering gulls

Photo Jonathan Felis

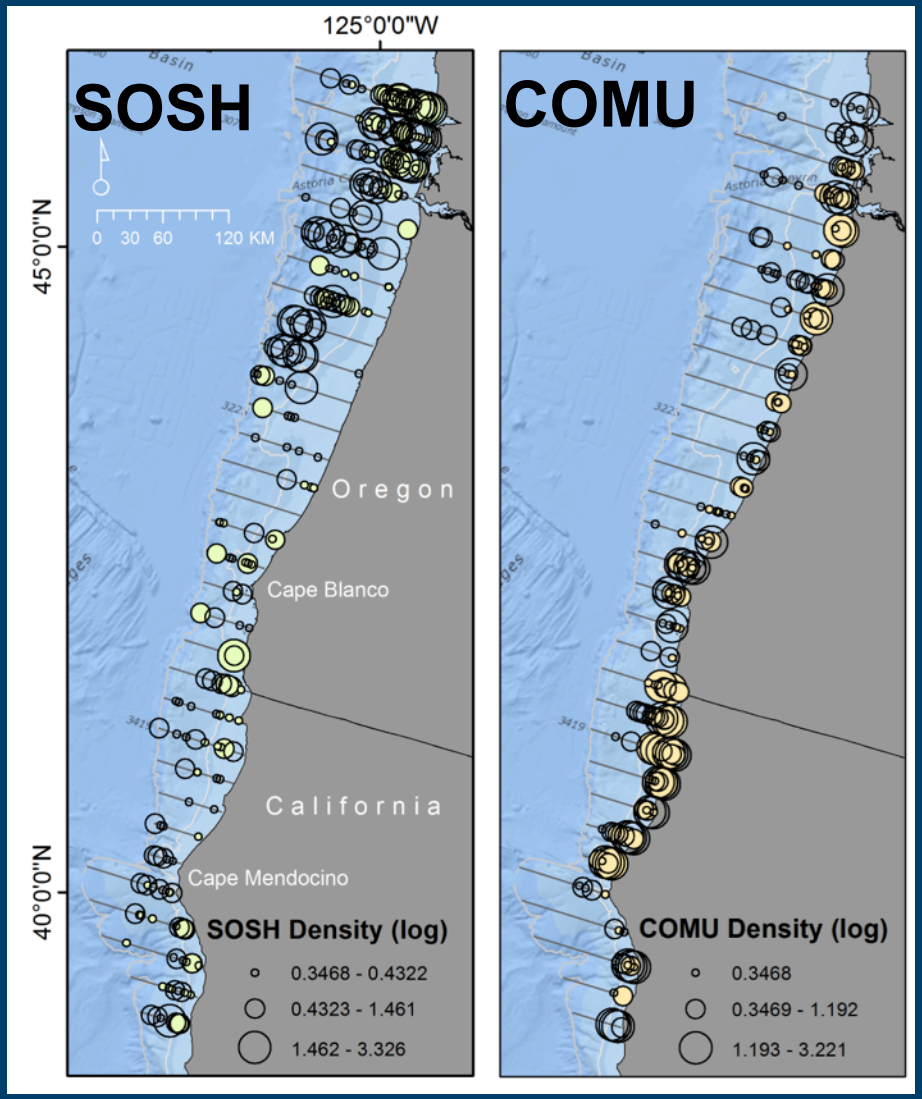
Photo Jeff Poklen



Inter-species distribution patterns

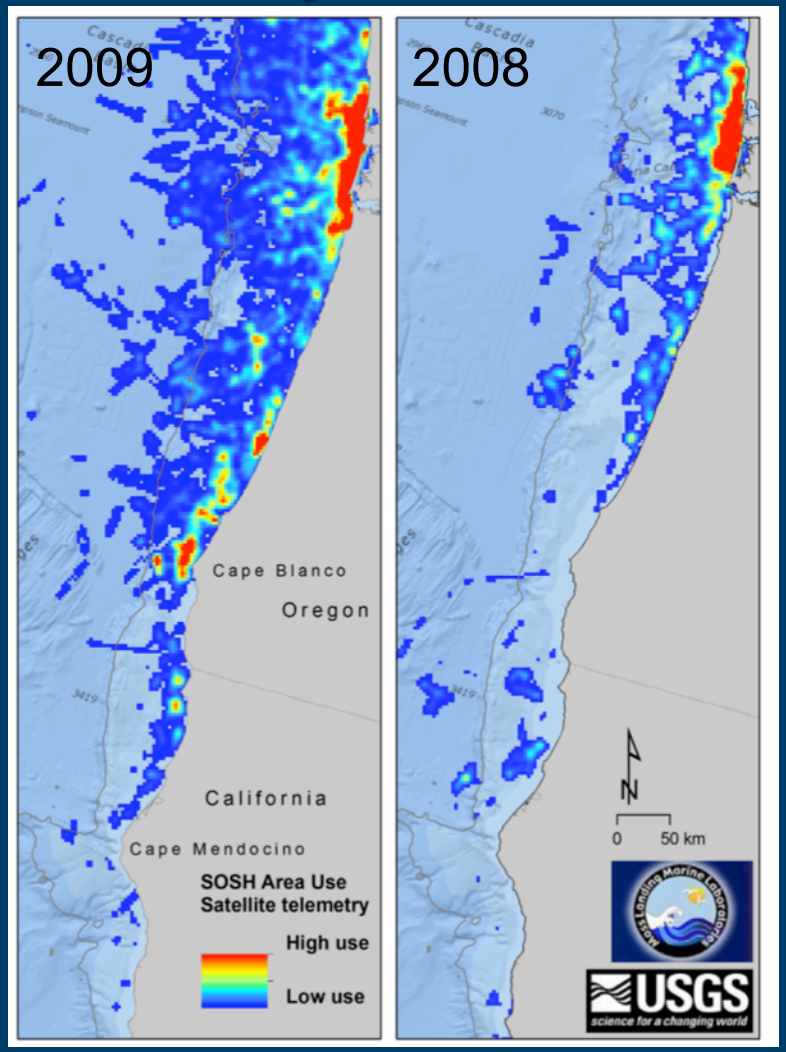
Photo Jonathan Felis

Photo Jonathan Felis



Open circles = 2011; filled circles = 2012

Telemetry-based area use vs. density snapshot



- USGS WERC has conducted marine bird telemetry since 1995 (>11 species within the CCS)
- Telemetry Provides area-use through time to better integrate species' responses to dynamic ocean conditions
- Techniques have been adopted world-wide for describing ranges, habitat affiliations, and hot-spots for MSP

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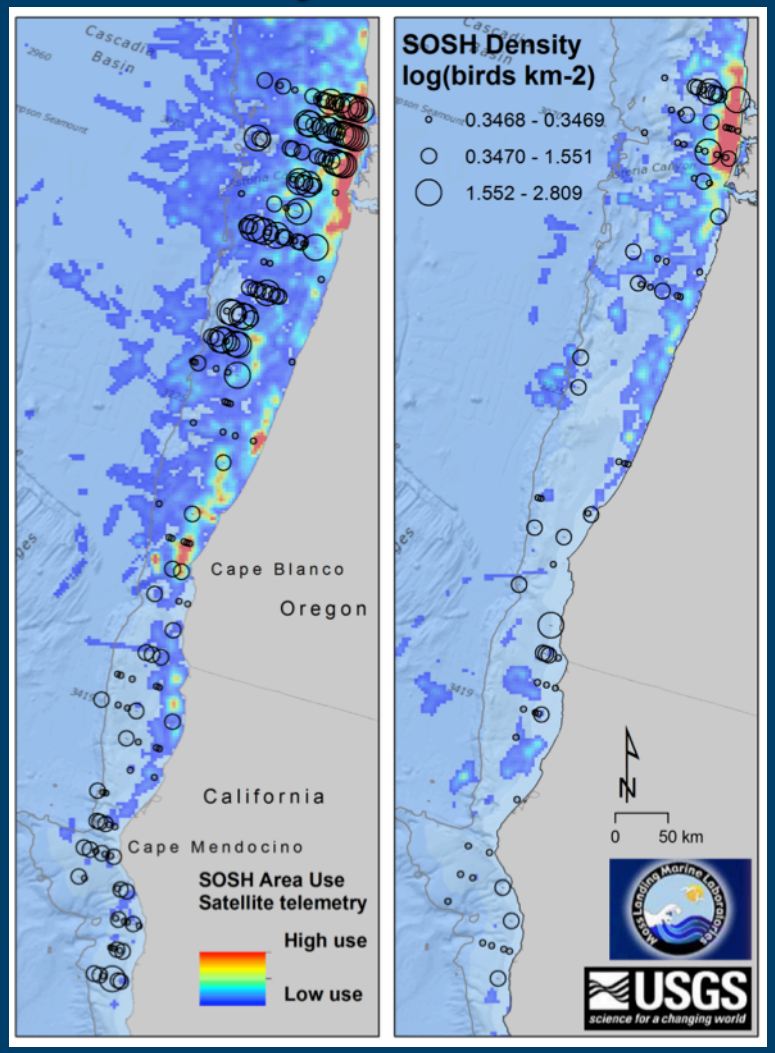
Adams *et al.* 2011, *Biological Conservation*

Telemetry-based area use vs. density snapshot



- Summer density distribution corresponds with area use
- Interannual variability in area use
- Well-defined hotspots off southern WA (Columbia River Plume) and off southern Oregon

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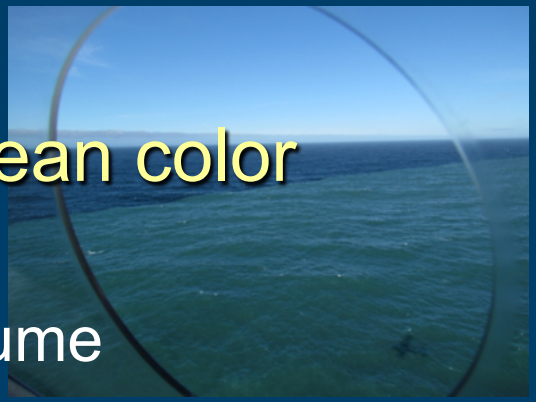
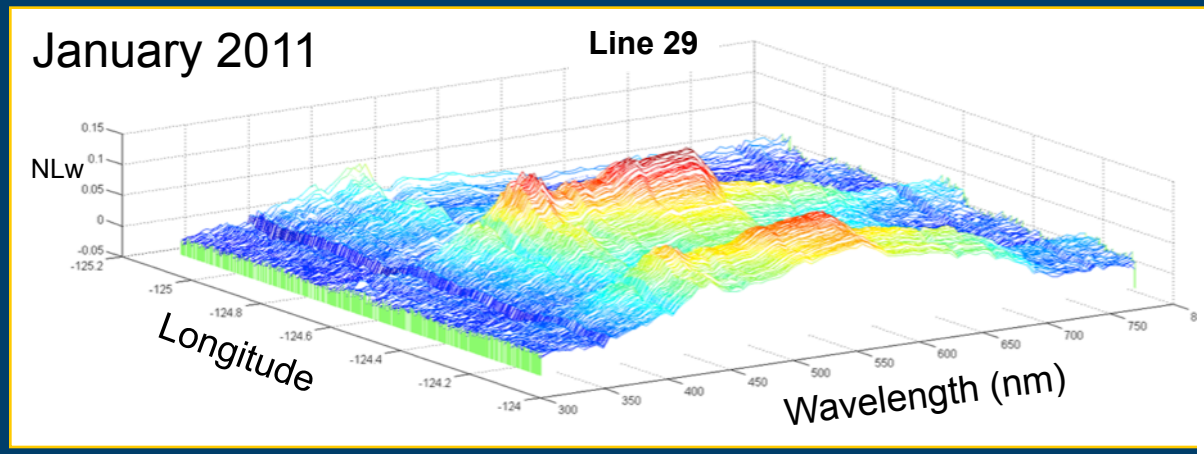
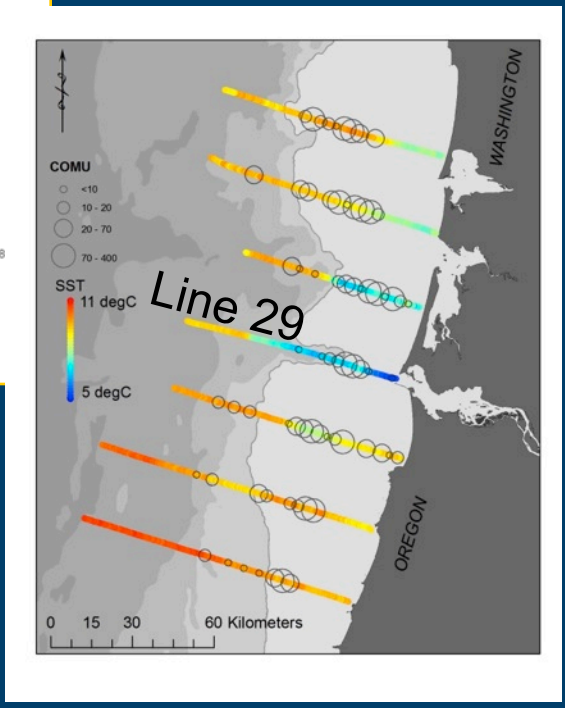
Adams *et al.* 2011, *Biological Conservation*

Mapping hi-resolution, multispectral ocean color



- Preliminary analyses of Columbia River Plume





- Effective delineation of fronts
- Future classification of water masses

Murres: hotspots in cold waters, or…?

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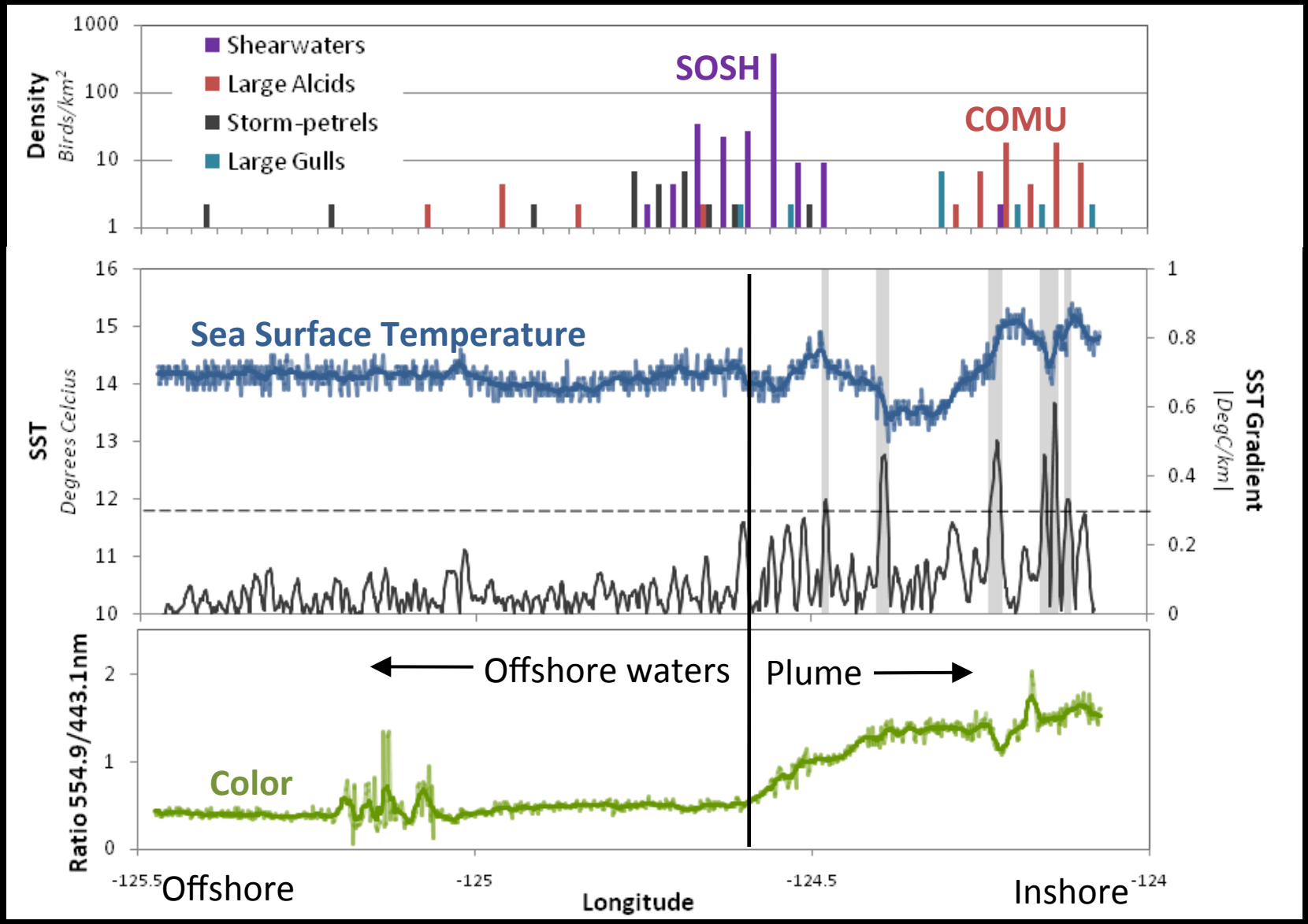
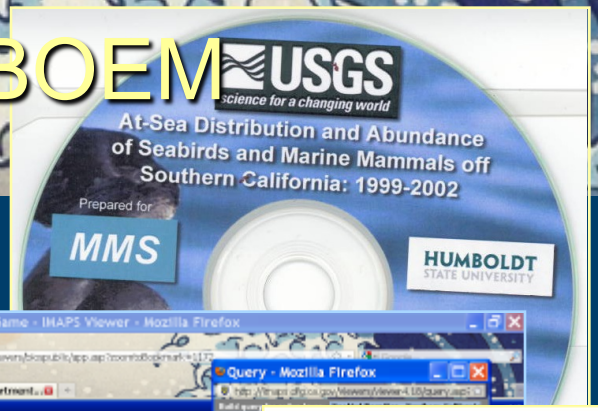
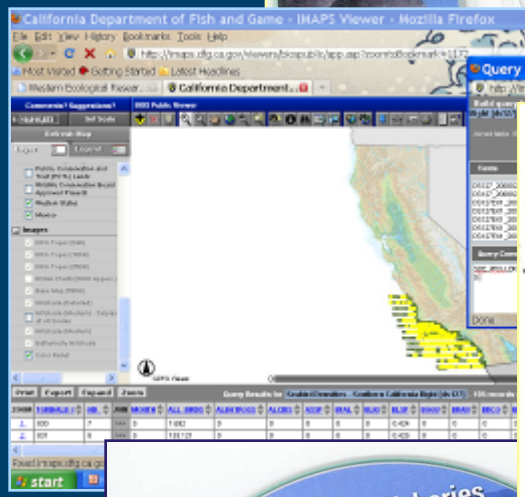
Seabird associations with the Columbia River Plume

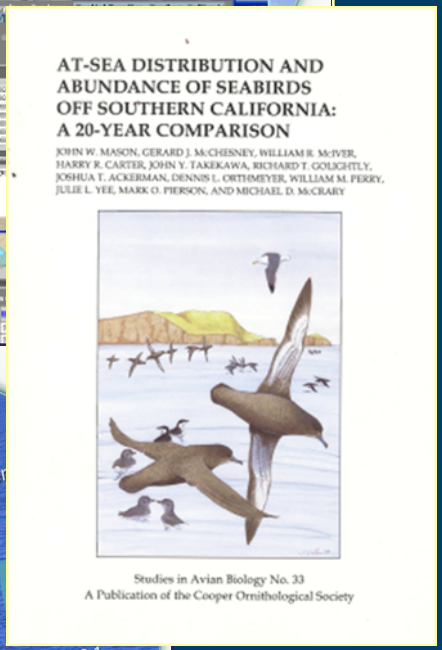


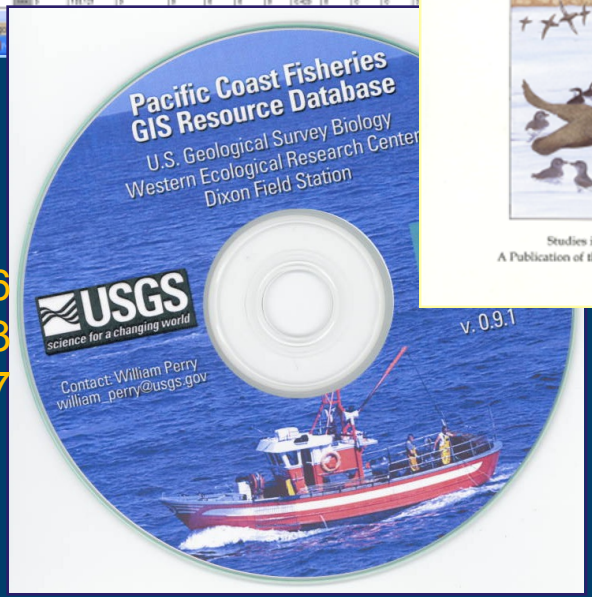
Previous USGS products for BOEM

- >10 peer-reviewed journal articles
- User-friendly geodatabases (stand-alone and web-based)
- Publically available summary density data (BIOS)









http://www.werc.usgs.gov/Project.aspx?ProjectID=106
http://www.werc.usgs.gov/Project.aspx?ProjectID=203
http://www.werc.usgs.gov/Project.aspx?ProjectID=237

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Photo Jon Felis

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