Seabirds and Offshore Wind Energy in the California Current: Potential Issues for Consideration

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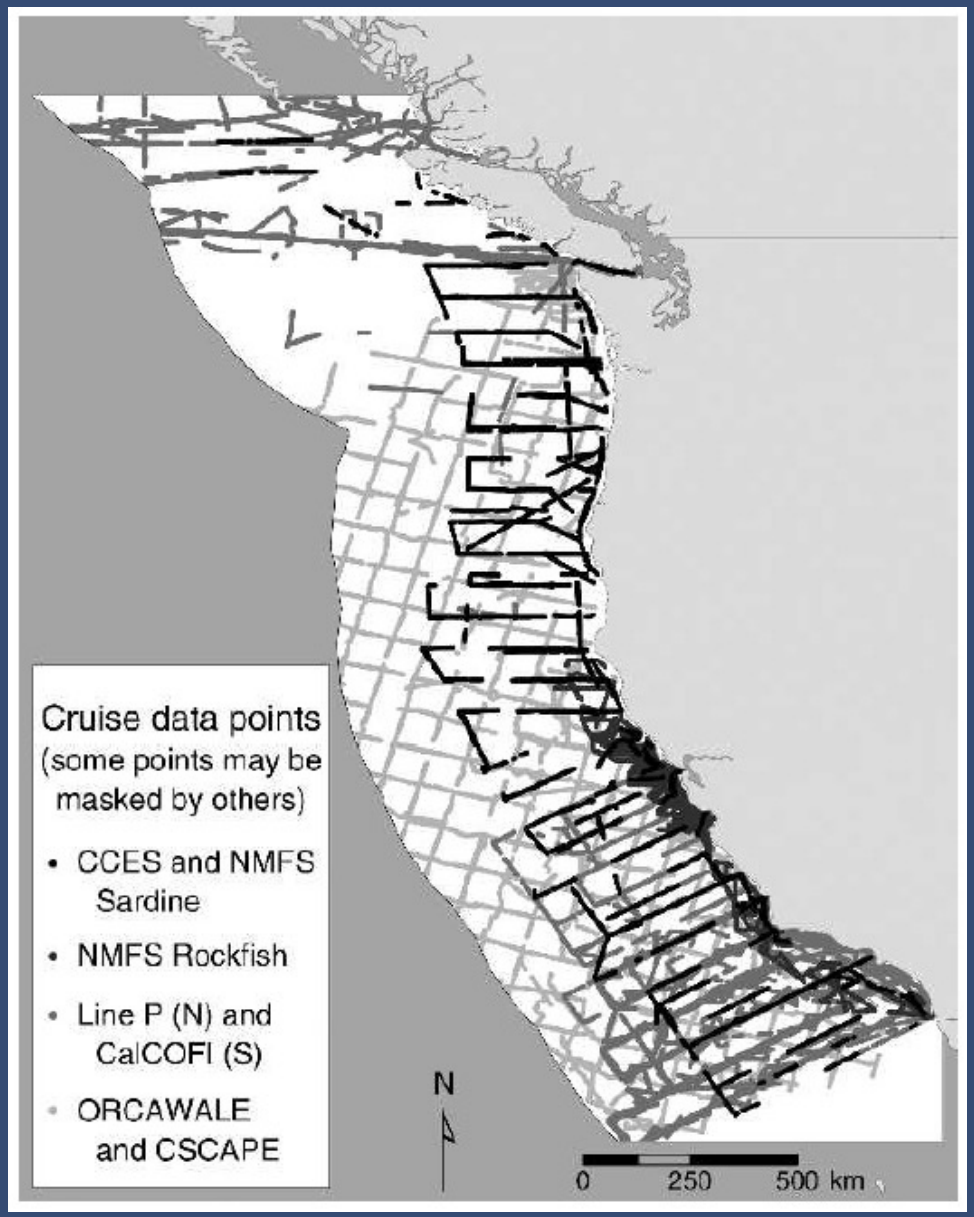
Seabird Occurrence Data

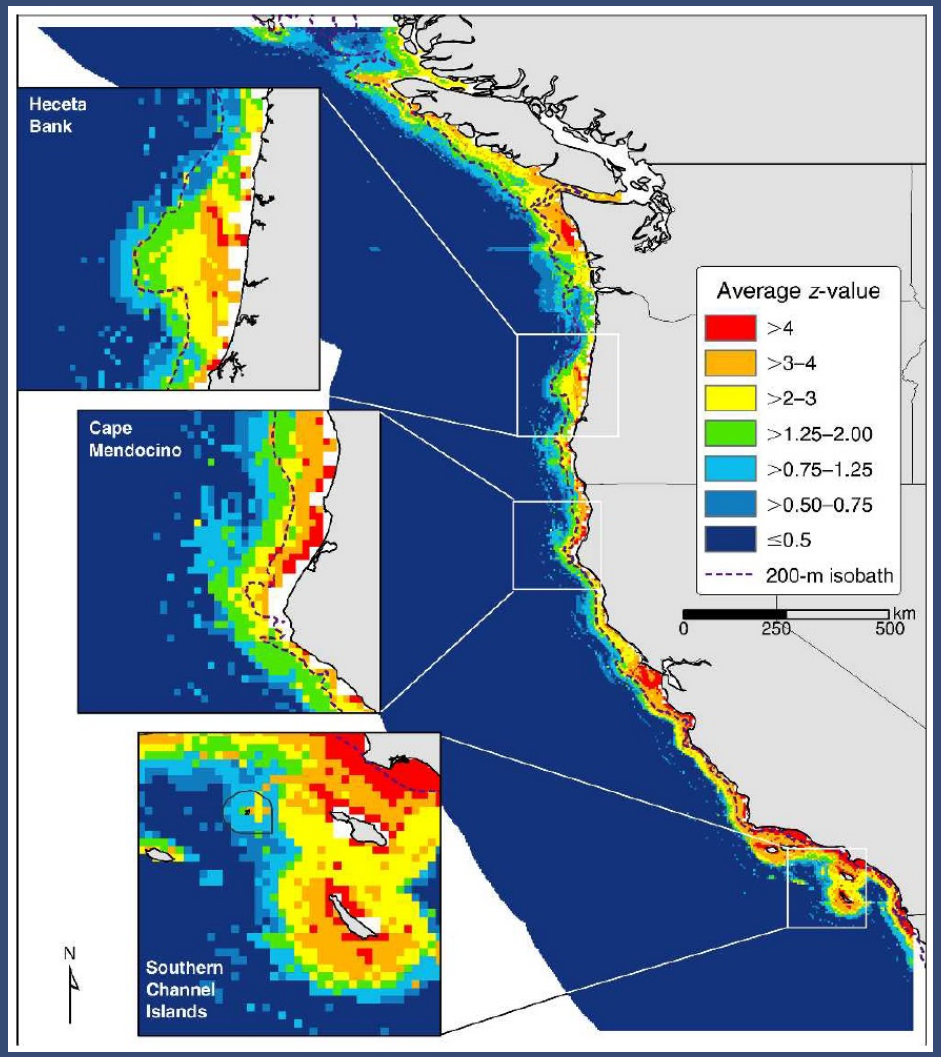


The California Current is probably the most data-rich stretch of ocean on the planet with regard to the number of surveys conducted to determine the abundance and distribution of seabirds and to identify "hotspots" of dense seabird occurrence.

Aerial and ship-based surveys from 1976 to the present = **26** datasets covering significant portions of the region; some surveys have continued annually for 30 years.

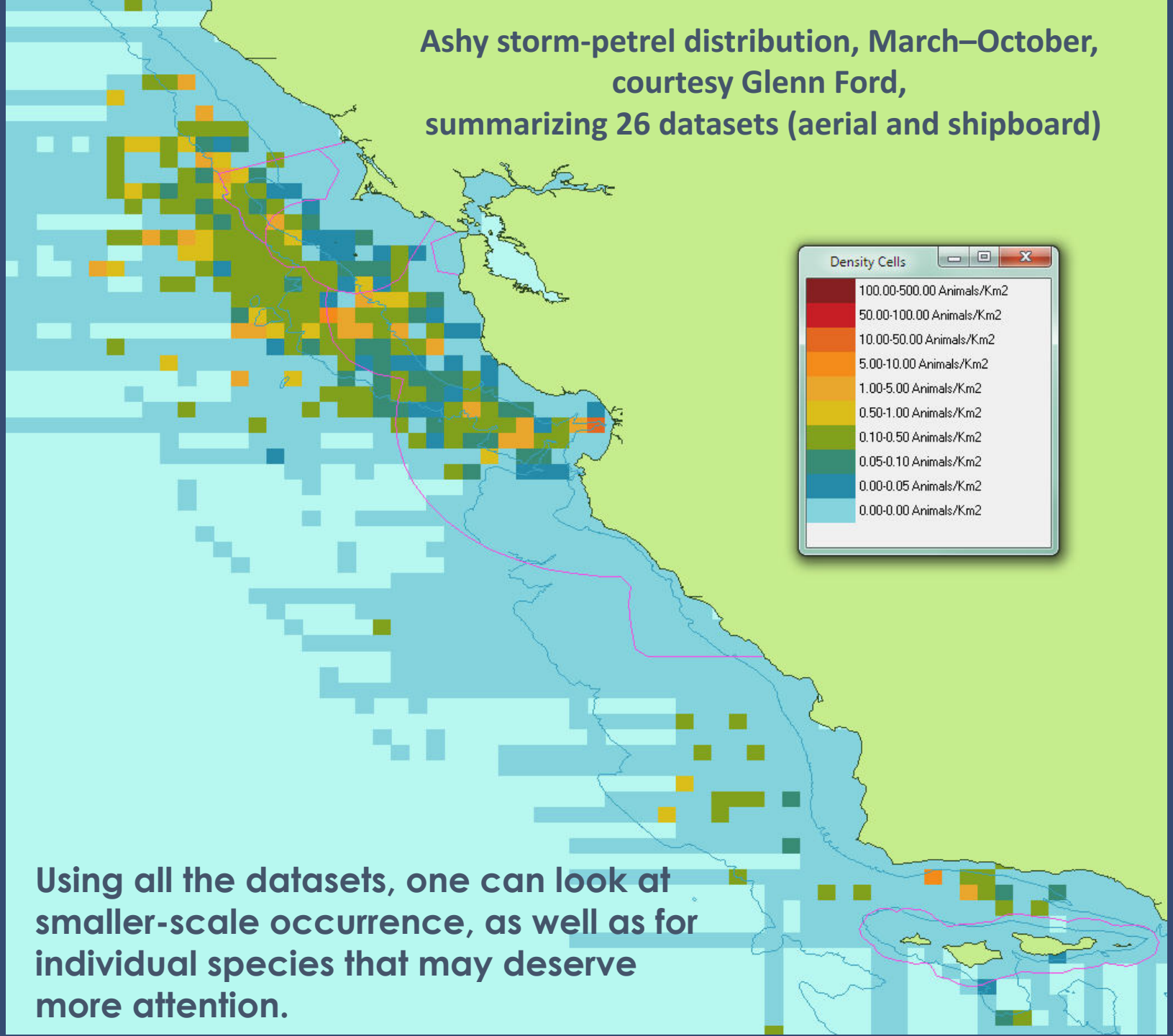
Coverage in seven of the datasets

Map of Seabird "Hotspots"

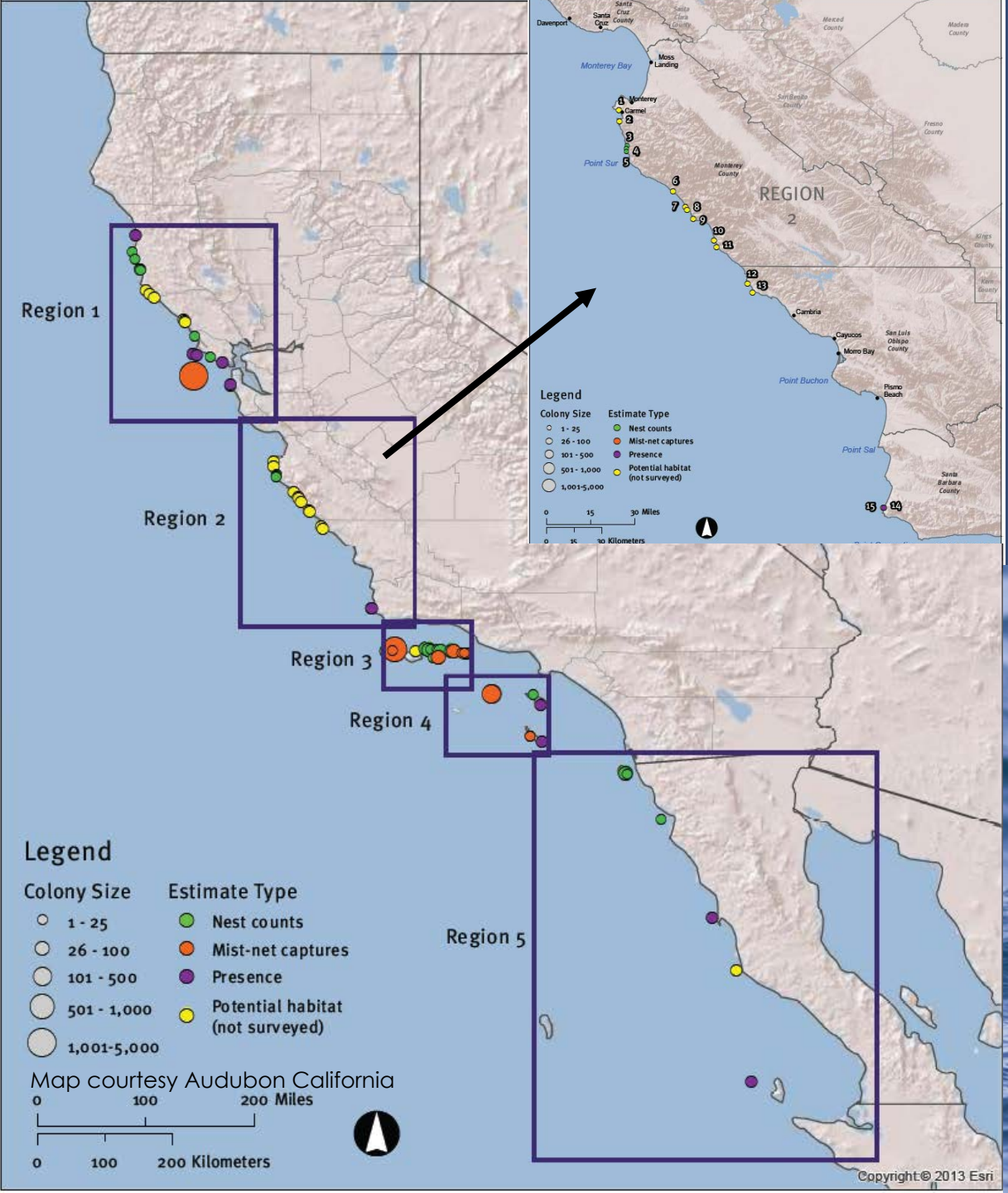


Summarizes datasets from the previous slide, based on average of (a) standardized abundance, (b) "importance" (cells with >25% of abundance), and (c) seasonal persistence of 16 species (Nur et al. 2011. Ecological Applications 21:2241–2256).

Owing to much greater ocean productivity, seabird density/abundance in the California current are orders of magnitude greater than along U.S. East Coast or coastal Europe, from which most current information on impacts of offshore wind generators is derived.


Ashy storm-petrel distribution, March–October,
courtesy Glenn Ford,
summarizing 26 datasets (aerial and shipboard)
Density Cells
100.00-500.00 Animals/Km2
50.00-100.00 Animals/Km2
10.00-50.00 Animals/Km2
5.00-10.00 Animals/Km2
1.00-5.00 Animals/Km2
0.50-1.00 Animals/Km2
0.10-0.50 Animals/Km2
0.05-0.10 Animals/Km2
0.00-0.05 Animals/Km2
0.00-0.00 Animals/Km2
Using all the datasets, one can look at smaller-scale occurrence, as well as for individual species that may deserve more attention.

Major seabird breeding colonies along the California coast are well known: Ashy Storm-petrel is an example

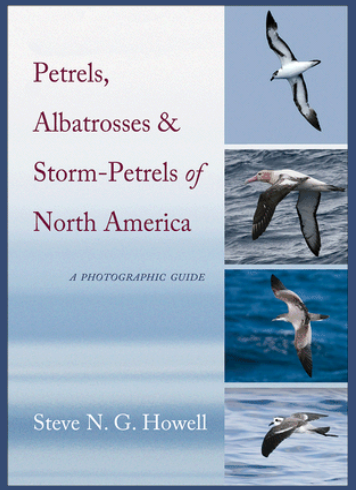


Greater Species Composition

Besides greater abundance, the species composition of California Current seabirds is far more complex and diverse than is found on the U.S. East Coast and coastal Europe.

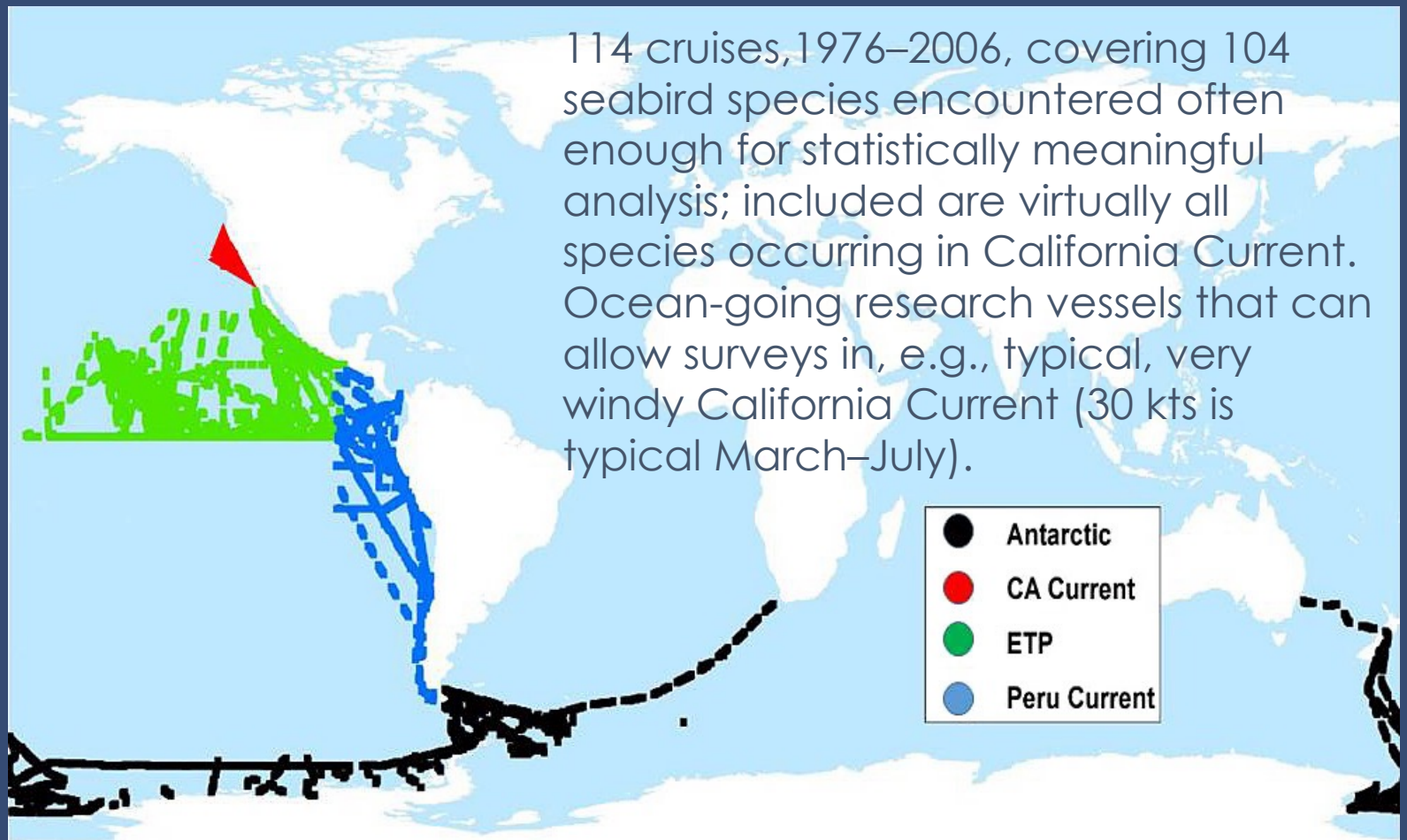
The narrow continental shelf off the U.S. West Coast, unlike U.S. East Coast and Europe, brings these "oceanic" species much closer to the coast, i.e. a few km.

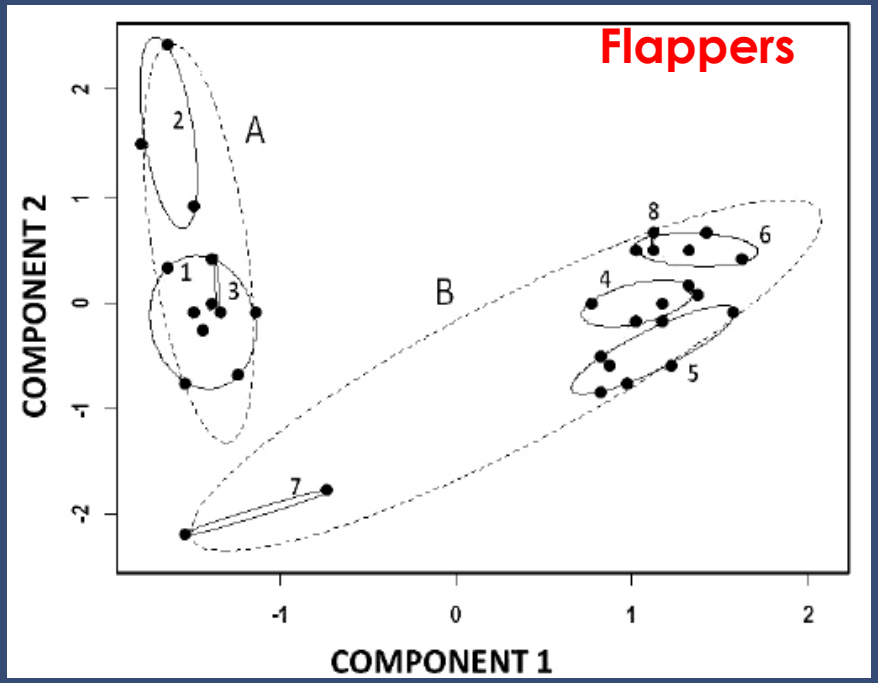
This is particularly true in regard to albatrosses, shearwaters, petrels, and storm-petrels, which are far more abundant in the California Current, and whose flight behavior and flight height is especially sensitive to wind strength.

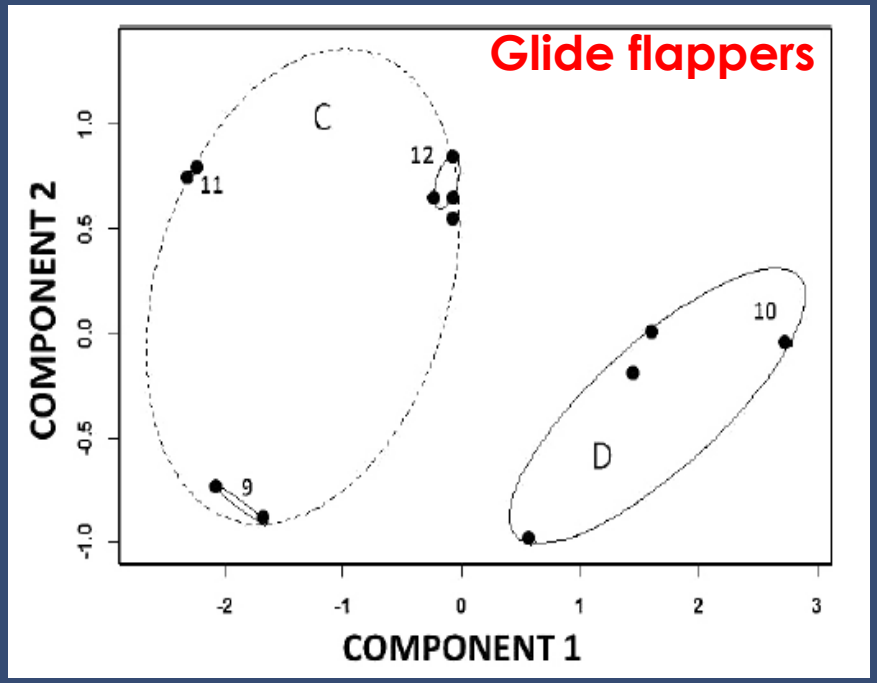


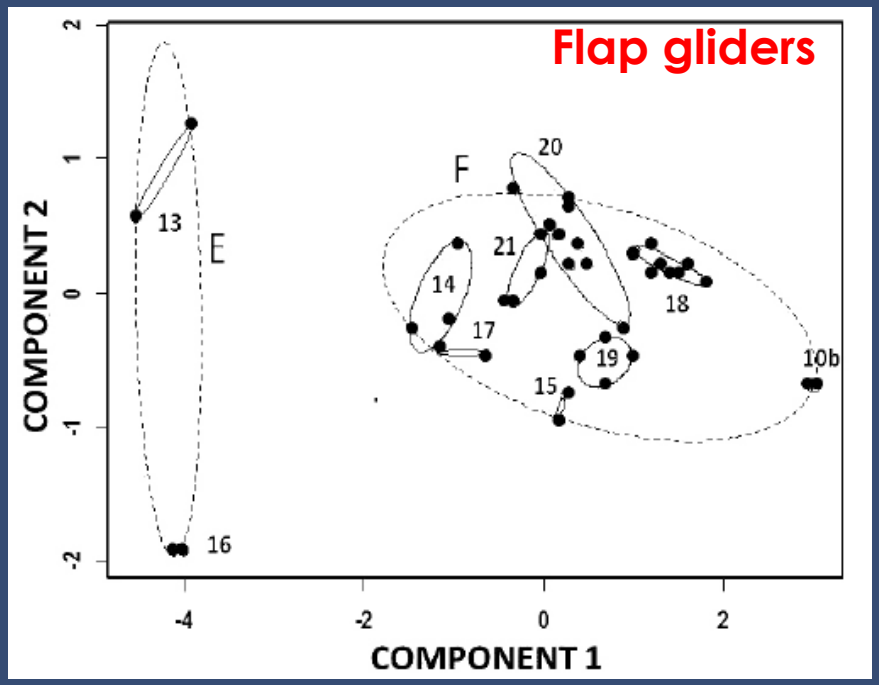
Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction

David G. Ainley, Elizabeth Porzig, David Zajanc, and Larry B. Spear,
H. T. Harvey & Associates, 983 University Avenue, Bldg D, Los Gatos, CA 95032, USA
(*Marine Ornithology* 43:25–36, 2015)

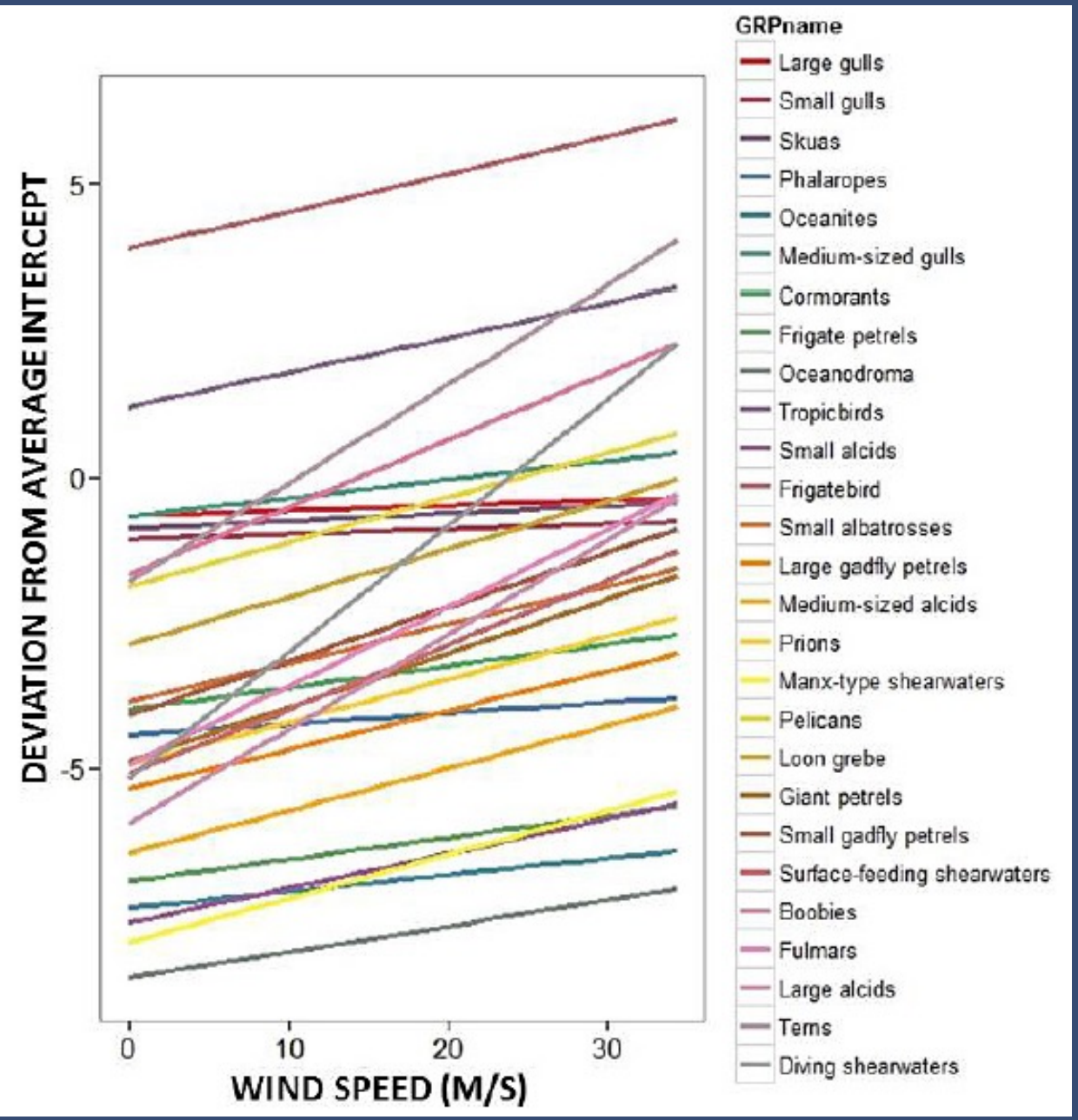




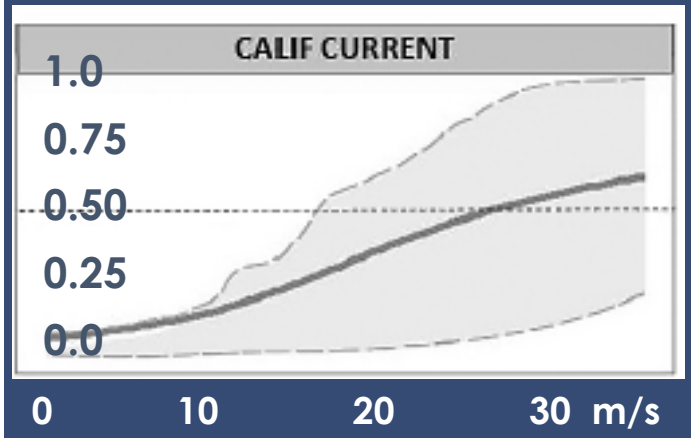




Species sort into groups based on flight morphology and ultimately flight characteristics



Flight style subgroups: some change flight height more readily as wind speed increases, particularly albatrosses, petrels, and shearwaters



Probability of flying higher than 10 m as function of wind speed

18 m/s = 35 kts, typical California Current winds

Some species groups more prone to changing flight style with increasing wind speed:

TABLE 6
Results of regression analyses of change in flight style with increasing wind speed[a]

	Flapping	Flap, few glides	Flap-gliding	Glide, few flaps	Gliding
Boobies	+	NS	-	NS	NS
Cormorants	+	NS	NS	-	NS
Diving shearwaters	NS	NS	-	-	+
Frigate petrels	NS	NS	-	NS	NS
Frigatebird	NS	NS	NS	NS	NS
Fulmars	+	NS	-	NS	+
Giant petrels	NS	NS	-	NA	+
Large alcids	+	NS	NS	-	NS
Large gadfly petrels	NS	NS	NS	-	+
Large gulls	+	-	NS	NS	NS
Loon/grebe	+	NS	NS	-	NS
Manx-type shearwaters	NS	-	+	-	NS
Medium-sized alcids	+	NS	NS	-	NS
Medium-sized gulls	-	NS	NS	NS	NS
Oceanites	NS	NS	NS	NS	NS
Oceanodroma	-	+	NS	NS	NS
Pelicans	+	NS	NS	NS	NS
Phalaropes	NS	NS	NS	NS	NS
Prions	NS	NS	NS	NS	NS
Skuas	NS	-	NS	NS	NS
Small albatrosses	NS	NS	-	-	+
Small alcids	NS	+	NS	NS	NS
Small gadfly petrels	NS	NS	-	NS	+
Small gulls	+	-	NS	NS	NS
Surface-feeding shearwaters	NS	NS	-	NS	+
Terns	+	NS	-	NS	-
Tropicbirds	+	NS	-	NS	NS

+ More flapping (more maneuverable)

- Less flapping, more gliding (less maneuverable)

Summary/Conclusions

- For the California Current, a huge amount of information is available on seabird occurrence, i.e., density hotspots and colonies, as well as seabird flight behavior as a function of wind speed.
- Distribution, density, seasonality, and flight height need to be evaluated when considering risk factors associated with turbine placement and design.

Summary/Conclusions

- Initial goal, perhaps: Derive a 3D picture of seabird presence and behavior as a function of the existing offshore wind regime; provide insight on the location of low environmental "conflict" areas for wind energy area siting, thereby helping garner and maintain public support.
- Data are robust enough to help inform potential site evaluation.
- After this process, remaining information gap is how Pacific "oceanic" seabirds will respond to offshore wind infrastructure, as a function of wind speed.

Questions and Discussion

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