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Deep Dive: Avian Considerations and Offshore Wind Projects in the California Current

Presented by:
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at the

California Offshore Renewables Environmental Regulatory Workshop

March 14, 2018

Avian Considerations for Offshore Wind

Marine Birds

- Collision
- Displacement
- Anthropogenic Lighting

Terrestrial Migrants Offshore

- Collision
- Anthropogenic Lighting

Migrant Terrestrial Birds

- **Much more of a potential issue in Atlantic, North Sea, and Gulf of Mexico than off the West Coast**
- **Many terrestrial breeding birds migrate at night**
- **Susceptible to artificial night lighting**
  - Attraction
  - Disorientation
  - Collision
  - Attraction to at-sea structures during inclement weather

Guy Tudor, Life Magazine, Sept 28, 1959

North Sea Landbird Migration

- **Large numbers of landbirds migrate across the North Sea on both their spring and fall migrations**
- **This represents a potential significant impact involving large numbers of migrant landbirds[1]**

[1] Hüppop, O., D. Dierschke, K. M. Exo, E. Fredrich, and R. Hill. 2006. Bird migration studies and potential collision risk with offshore wind turbines. Ibis 148:90–109.

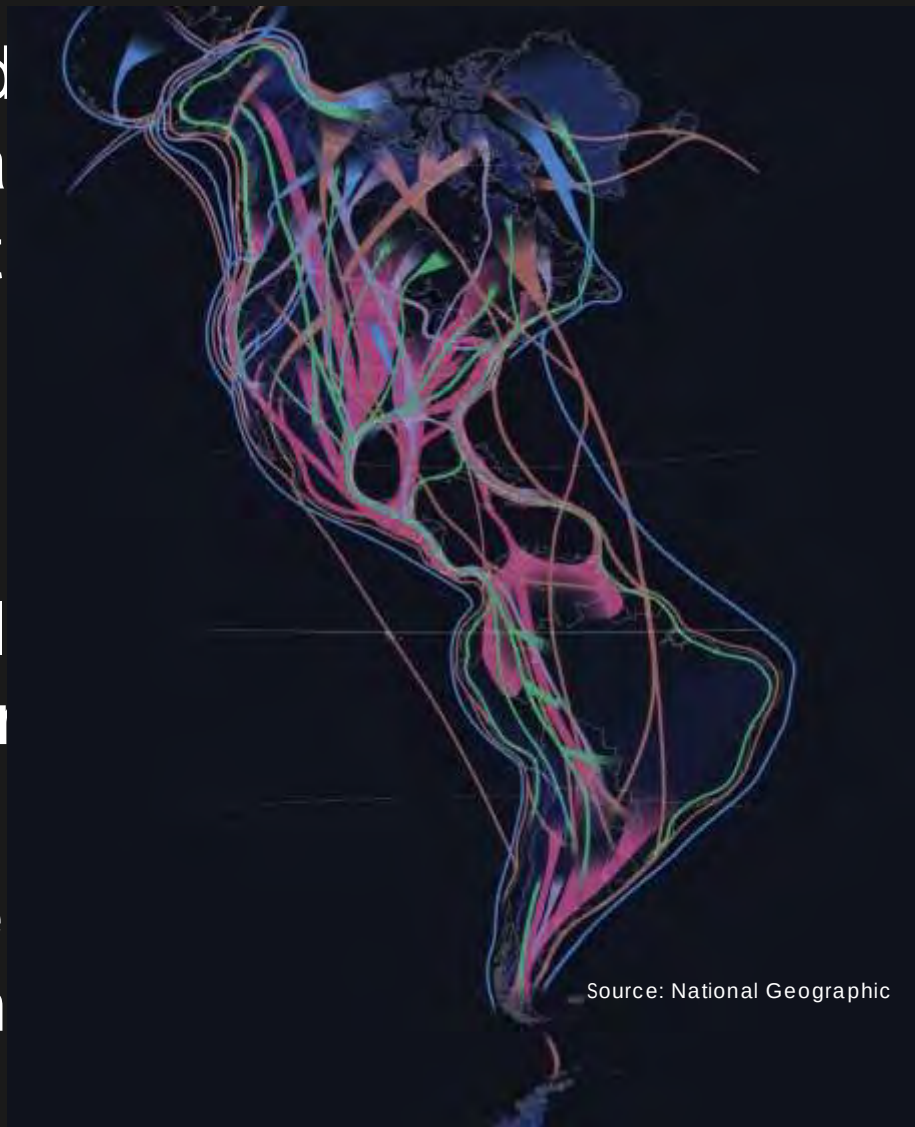
Landbird Migration

General migratory direction is northwest to southeast in fall to wintering grounds, and the opposite in spring. Thus, large numbers of migrants cross the Gulf of Mexico, and some species even cross the Atlantic to get to the Caribbean and South America in fall.

Kristen M. Covino

Landbird Migration Patterns in California

- Due to the northwest to southeast migration of land they do not “want” to migra offshore of the West Coast United States.
- Disoriented migrants and “drifting” migrants wind up offshore, but it is a relativel event and typically weather dependent.
- Probably not a major issue California, at least far offsh



Source: National Geographic

General Considerations for Seabirds

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Collision
Displacement
Habitat Loss
Lighting
Spills

Jim Danzenbaker

Jim Danzenbaker

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Many Studies and Monitoring Efforts in the Atlantic

- **Some of the results with similar species groups in both oceans, especially in the nearshore environment, may be extrapolated to the Pacific, especially nearshore, but Atlantic results are not applicable for many species in the California Current.**
- **Major differences regarding species in the Pacific are especially pronounced off the Outer Continental Shelf.**

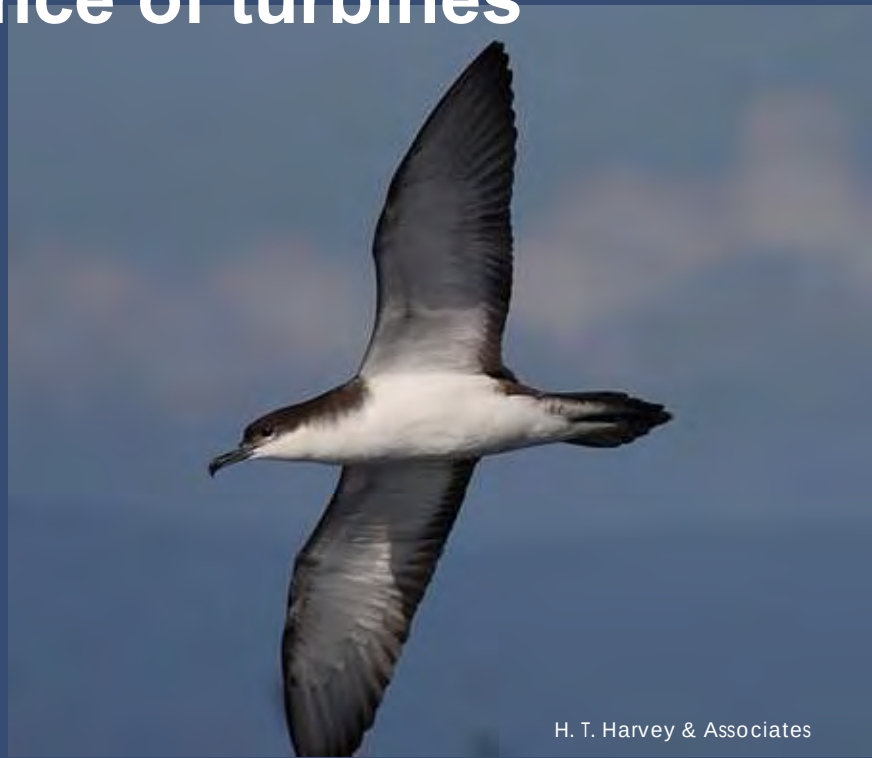
Responses of California Current Birds to Offshore Wind

- **Develop risk models**
  - Pacific seabird flight height and behavior
  - Hot spots
    - Breeding
    - Foraging
    - Migration
    - Wintering

Jim Danzenbaker

Seabird Behavioral Response to Presence of Wind Turbines

- **Risk models are a necessary first step**
- **But, we have no *a priori* information on how pelagic birds that fly high under high winds will respond to the presence of turbines**
  - May avoid them entirely
  - May be indifferent
  - May collide



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Monitoring

- **Likely that only monitoring will provide data on pelagic bird behavioral responses**
- **Monitoring in deep water is quite difficult**
  - Observational monitoring
  - Monitoring technology

Linda Terrill

Significant Impacts

- Unlikely to have significant impacts on landbirds off the Outer Continental Shelf off California
- Turbine safety and navigational lights should be able to be designed to minimize impacts on seabirds
- Unknown whether offshore wind projects will have significant impacts on pelagic birds, **but the risk is present…more information is** needed

Possible Minimization Measures

Detection and deterrence and cutoff systems are being developed for terrestrial wind projects—technology may be applicable to offshore wind

Strategic shutdowns, for example, during unusually heavy movements of sensitive species in project area (shifting resources in pelagic environment)

Possible Mitigation Measures

Mitigation measures on breeding grounds of target species

- Predator control
- Habitat management
- Artificial nest structures
- Social attraction

Financial support to reduce seabird bycatch

L. Young, Pacific Rim Conservation

Vero Cortes

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Seabird Mitigation for Terrestrial Wind in Hawaii

Newell's Shearwater

Predator exclusion fencing

Social attraction

Creating new breeding colony

Working right on schedule

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Summary

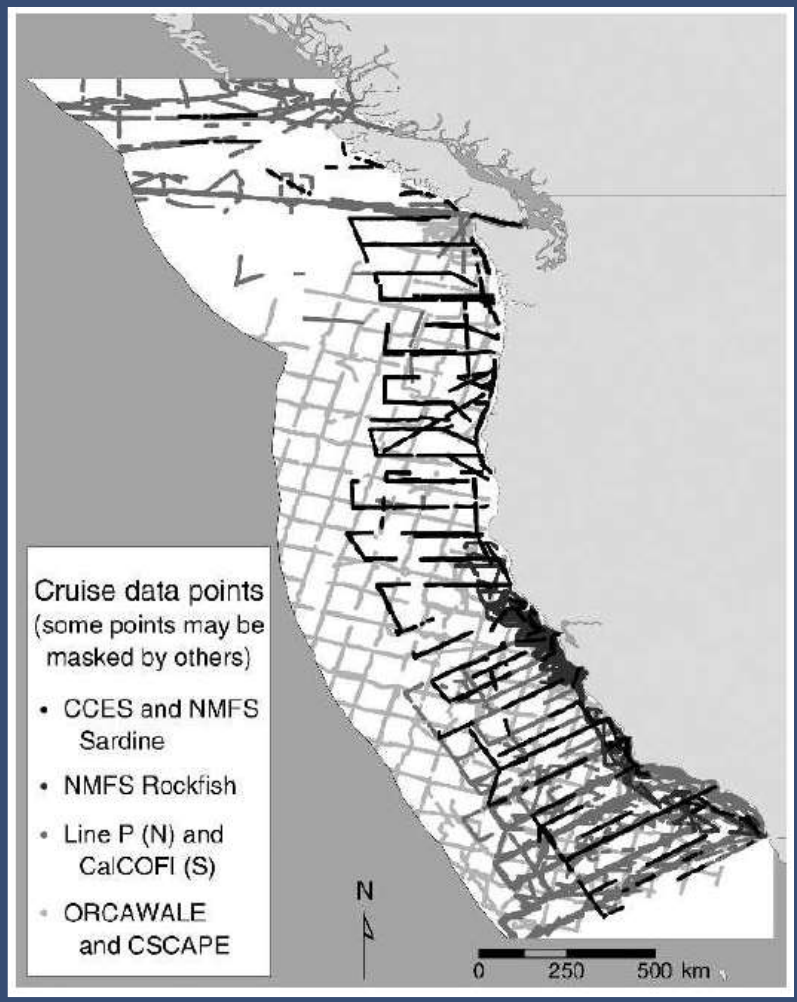
- **Offshore wind off California not likely to represent major impact on migrant landbirds, at least far offshore.**
- **Current Atlantic data not extrapolatable to many species off of California.**
- **Response to offshore turbines by pelagic species in California Current unknown; monitoring will be required to determine response.**
- **If risk turns out to be significant, minimization and mitigation measures may be possible.**

Offshore Wind and California Current Birds

- **For California Current, copious data are available on seabird occurrence, density hotspots, and flight behavior as a function of wind speed.**
- **Modeling could show which offshore wind sites are promising and which are likely to encounter issues with seabird interactions.**

The California Current

- **For seabird abundance and distribution data, may be world's richest ocean area**
- **Hotspots of dense seabird occurrence identified**
- **Aerial and ship-based surveys since 1976 = 26 data sets**
- **Data sets cover large areas**
- **Some surveys have continued annually for 30 years**



Coverage of seven data sets

Source: Nur, N., J. Jahncke, M.P. Herzog, J. Howar, K.D. Hyrenbach, J.E. Zamon, D.G. Ainley, J.A. Wiens, K. Morgan, L.T. Balance, & D. Stralberg. 2011. Where the wild things are: predicting hotspots of seabird aggregations in the California Current System. Ecological Applications, 21: 2241–2257.

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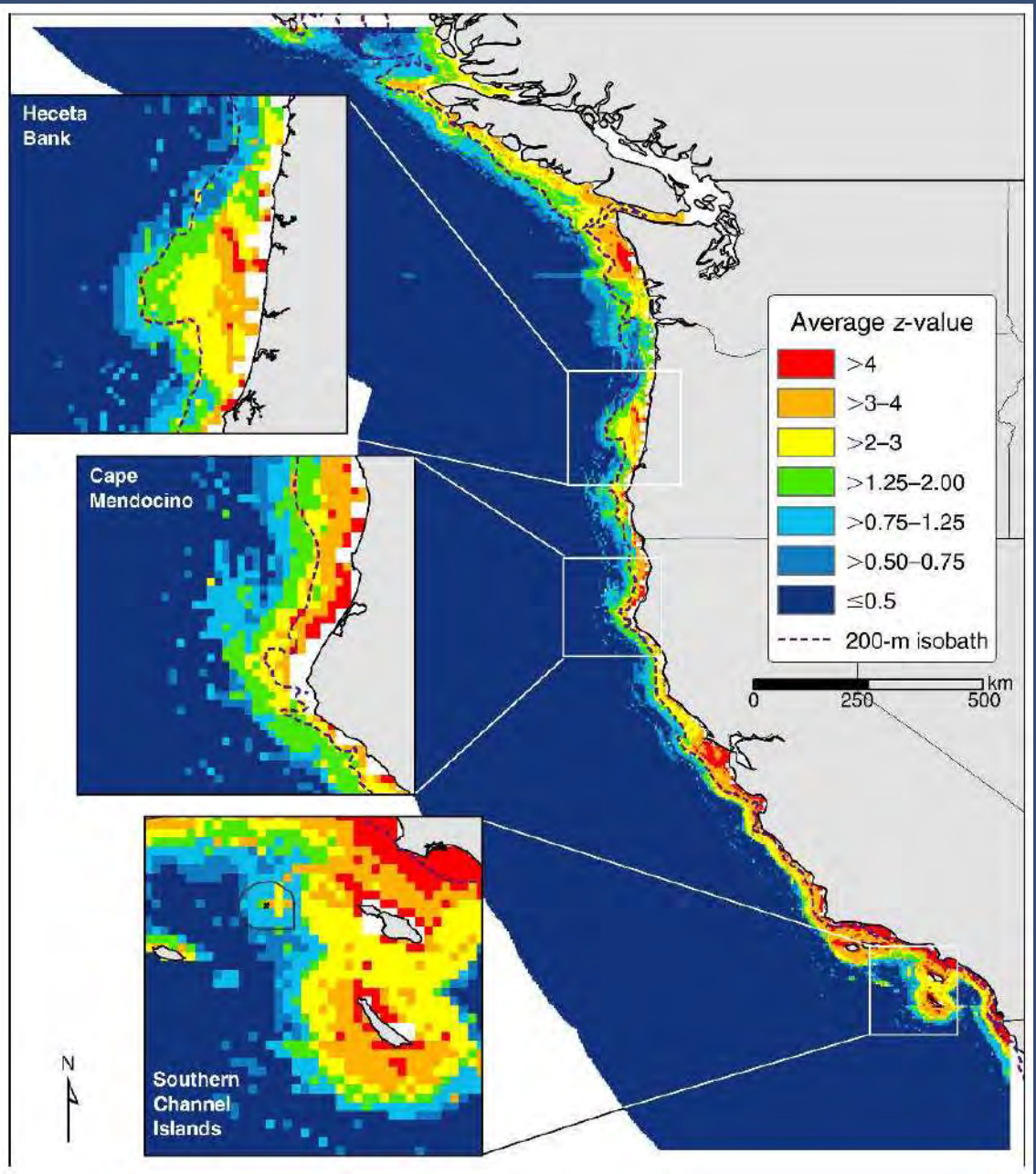
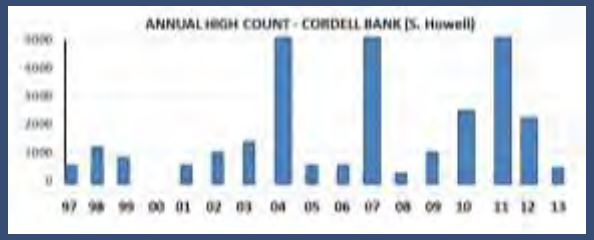
Known Hotspots for 16 Species

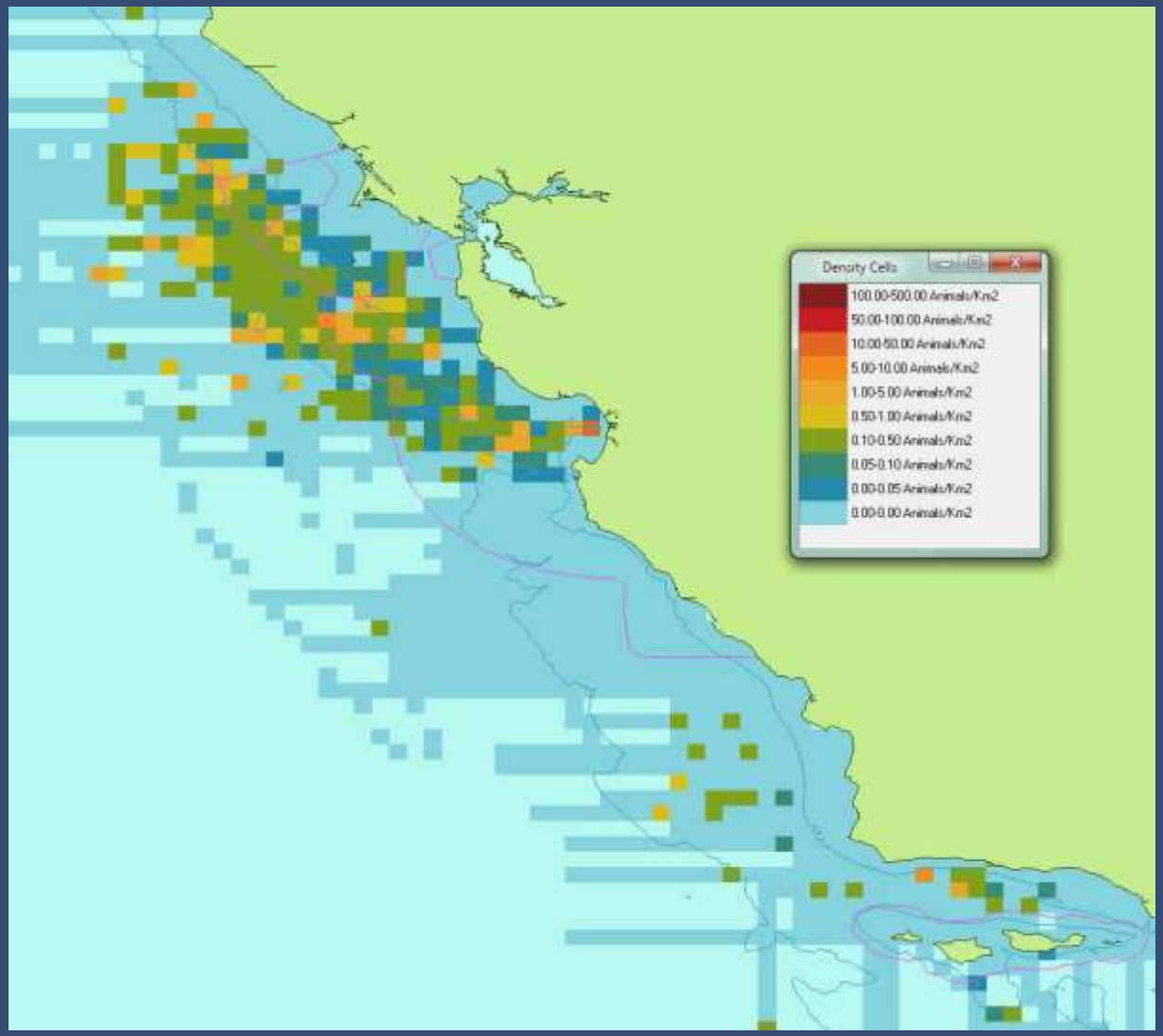


...though not necessarily those most susceptible to turbine collision as a function of flight style

Source: Nur, N., J. Jahncke, M.P. Herzog, J. Howar, K.D. Hyrenbach, J.E. Zamon, D.G. Ainley, J.A. Wiens, K. Morgan, L.T. Balance, & D. Stralberg. 2011. Where the wild things are: predicting hotspots of seabird aggregations in the California Current System. Ecological Applications, 21: 2241–2257.

Granular Data for Single Species





Ashy storm-petrel distribution, March-October, courtesy Glenn Ford, summarizing 26 data sets (aerial and shipboard)

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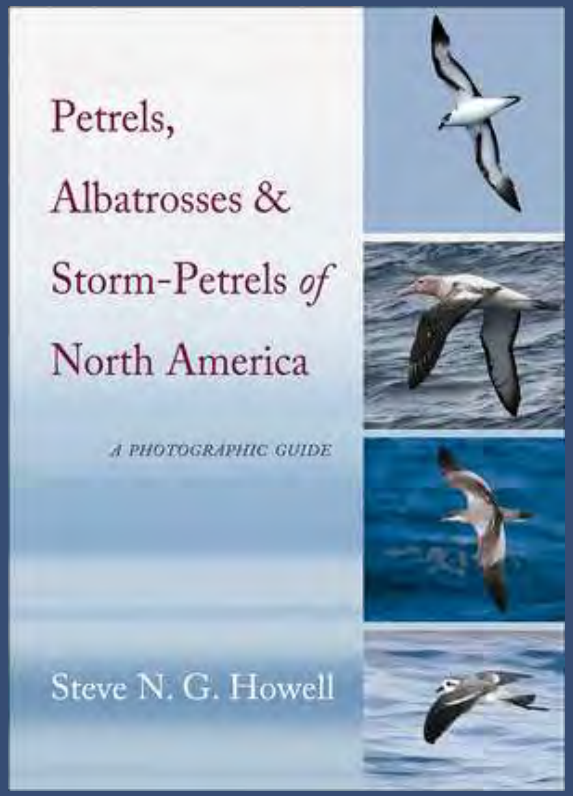
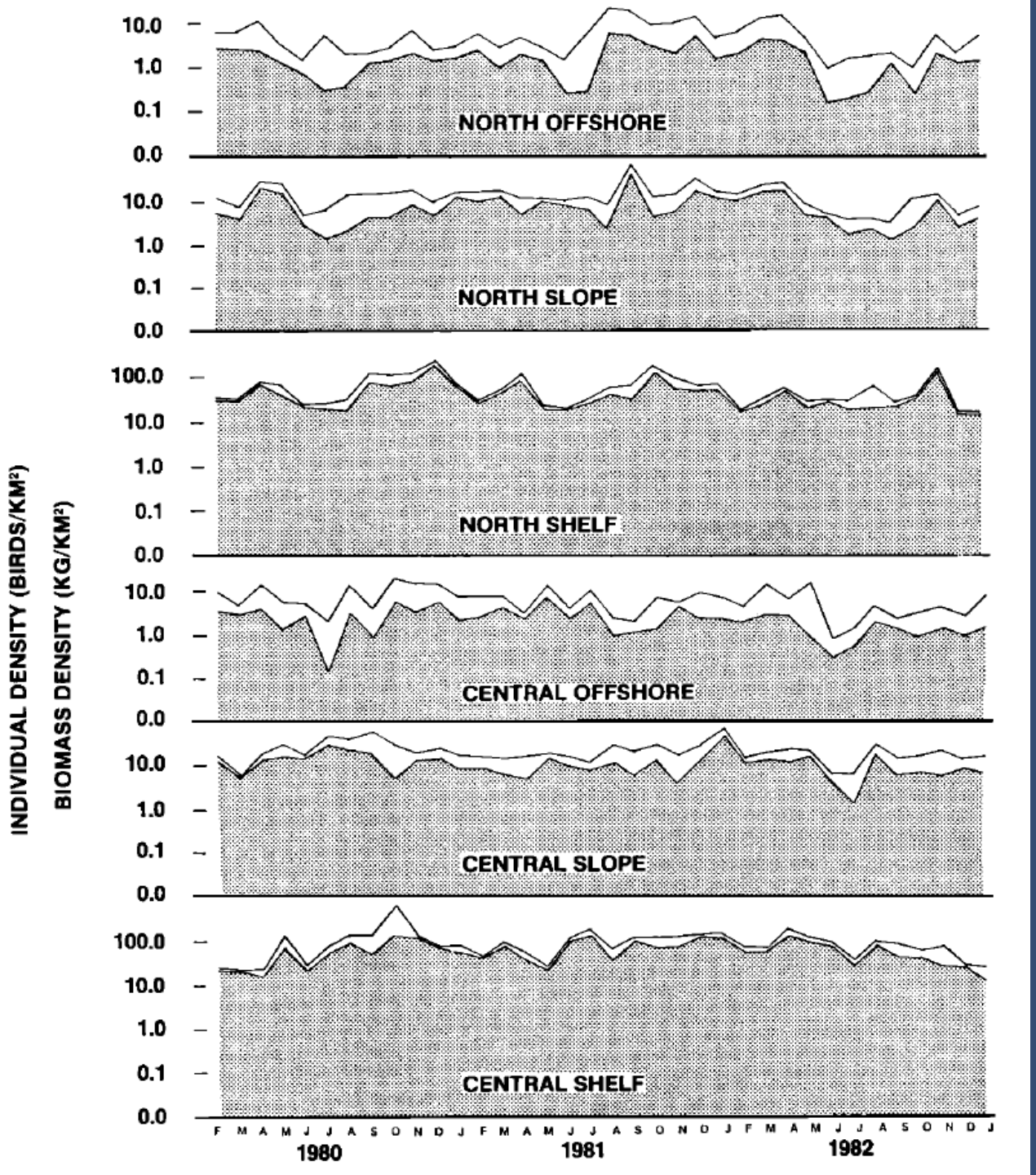
California Current Differs from East Coast and Europe

The California Current has:

- **Greater abundance of seabirds**
- **More complex and diverse species composition**

  Especially true for albatrosses, shearwaters, petrels, and storm-petrels (whose flight behavior and flight height is especially sensitive to wind strength)
- **Narrow continental shelf means oceanic species are closer to coast**





Briggs et al. 1987

North = Pt. Reyes to Oregon border

Central = Pt. Reyes to Point Conception

Seabird density considered at large scale average is likely an order of magnitude higher than on East Coast or off Europe.

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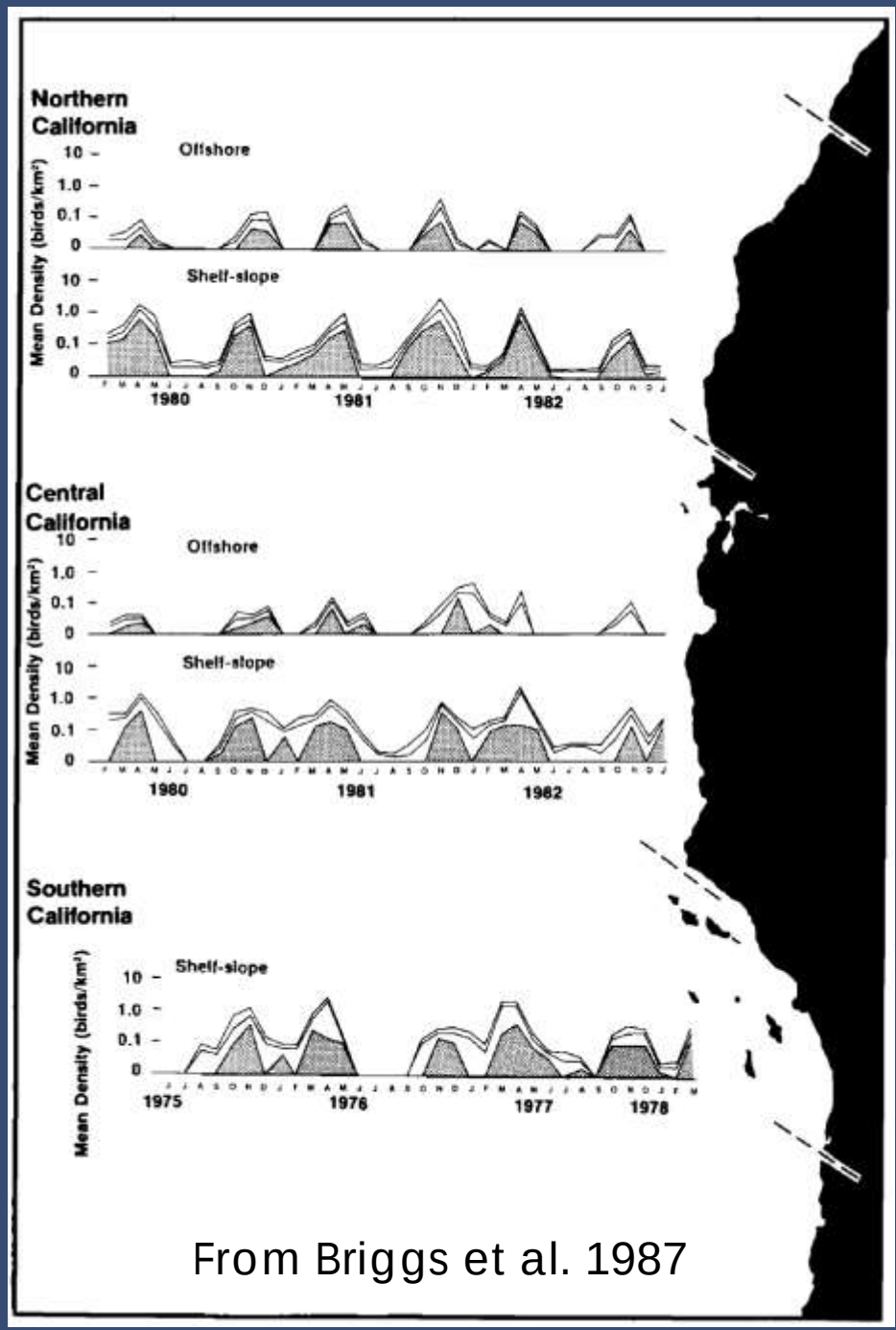
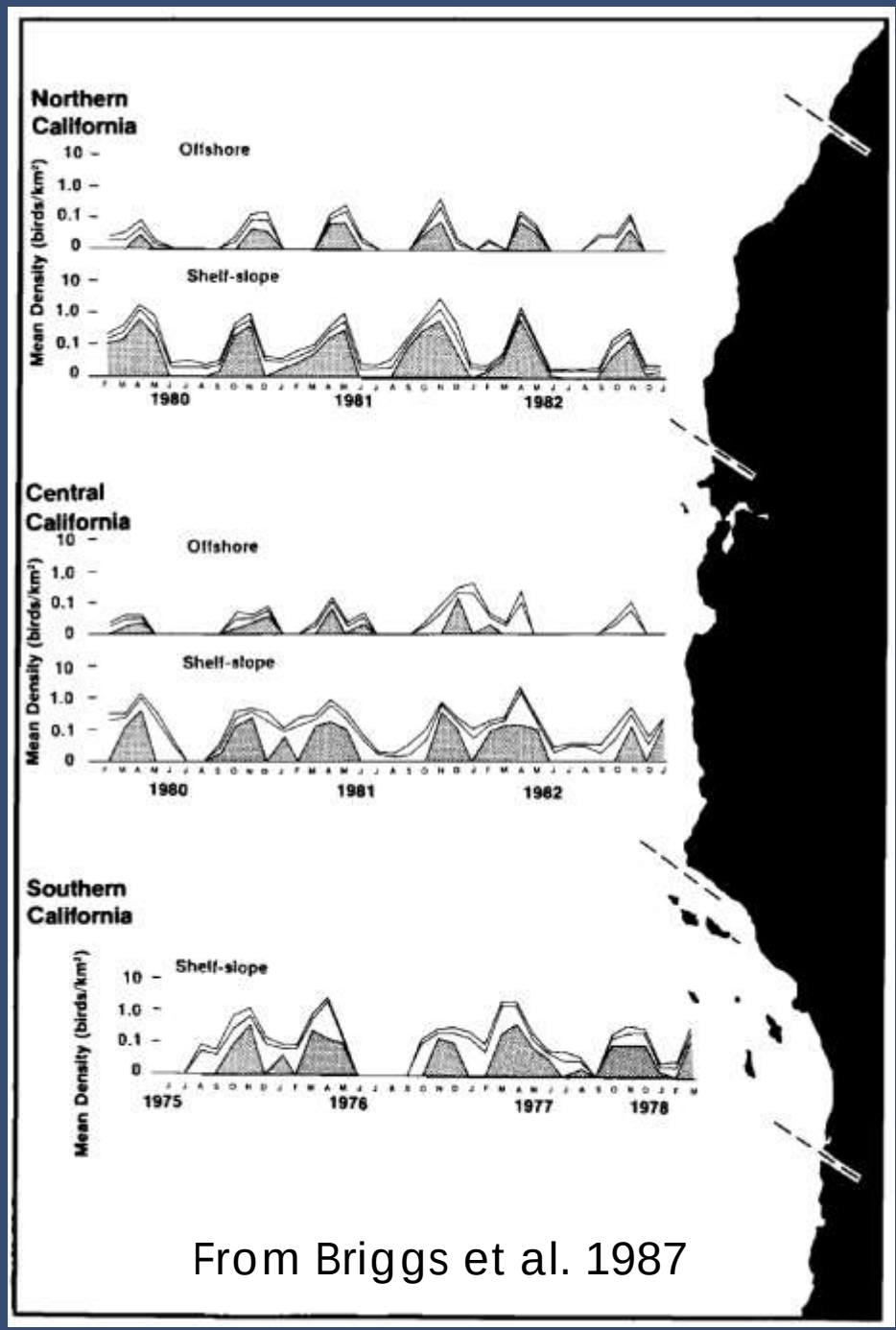
One type of seabird that is prevalent in Europe and East Coast is the “diver” or loon.

Here, Pacific loon is equivalent to black-throated, red-throated, and great northern divers of Europe.



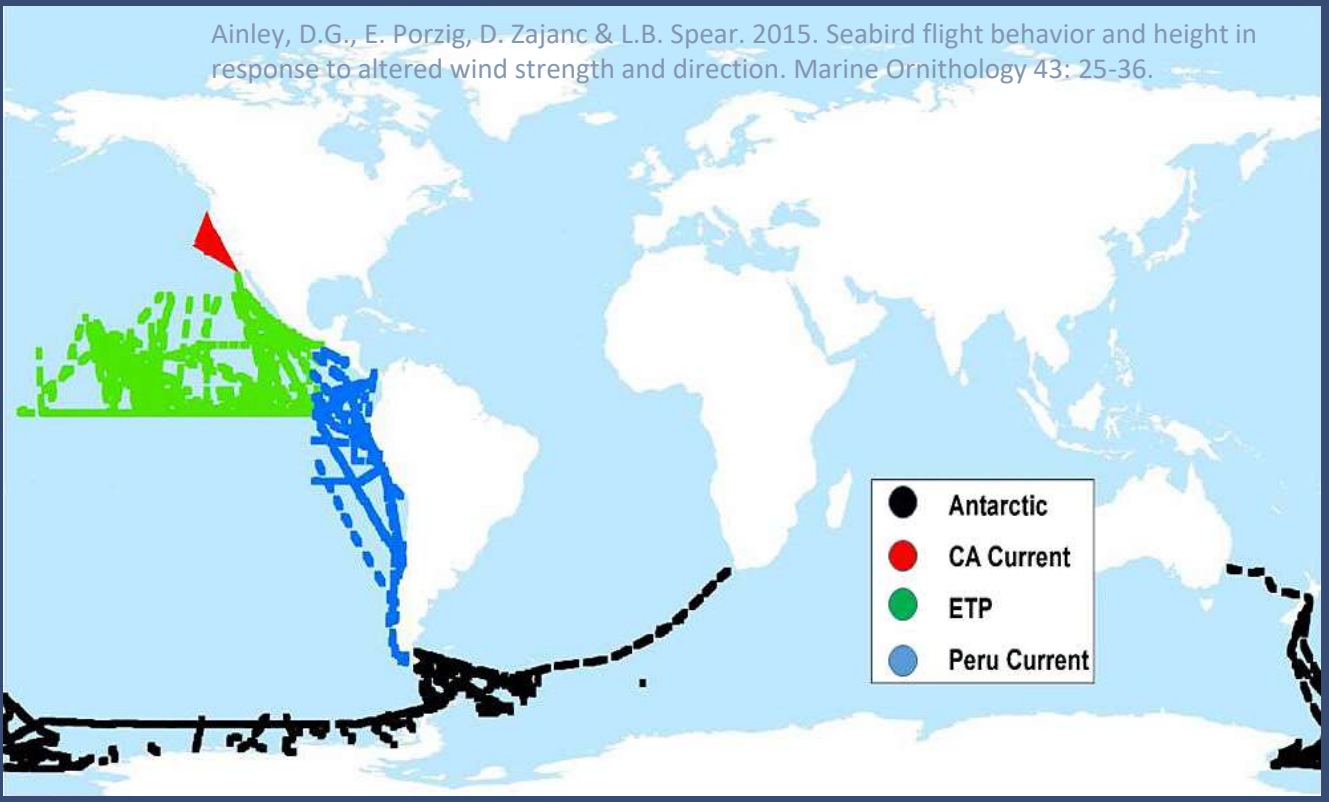
From Briggs et al. 1987

On West Coast, these species, along with various waterfowl species, mostly occur within a few miles of the coast. The exception is a very short period of fall and spring migration when migratory flocks fly offshore, taking the shortest distance between capes, etc.



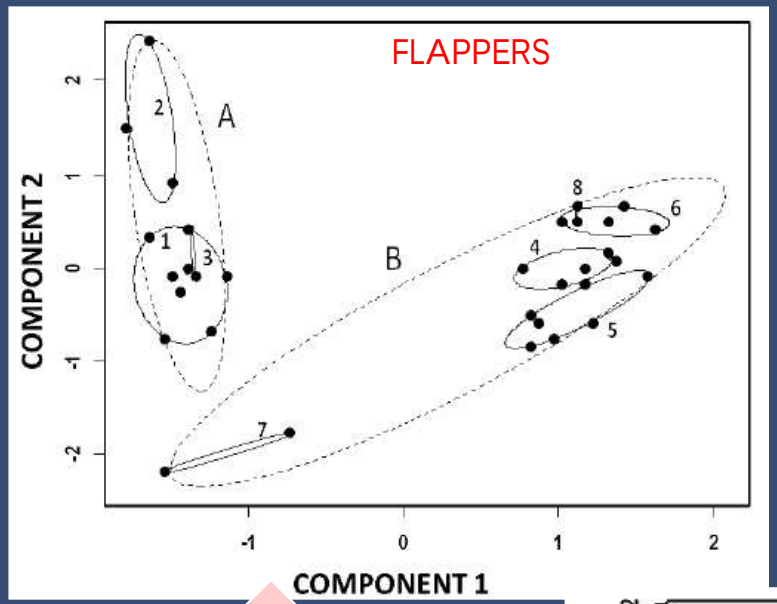
From Briggs et al. 1987

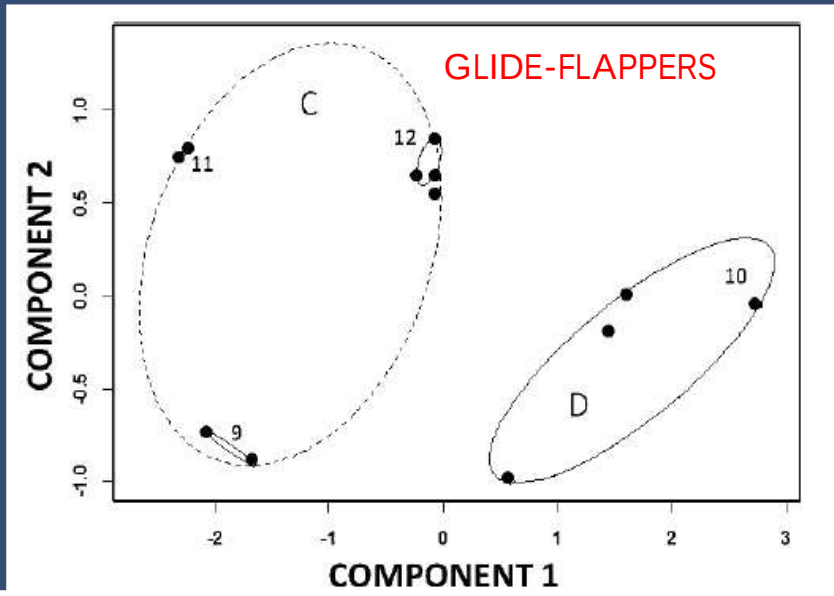
Study: Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction



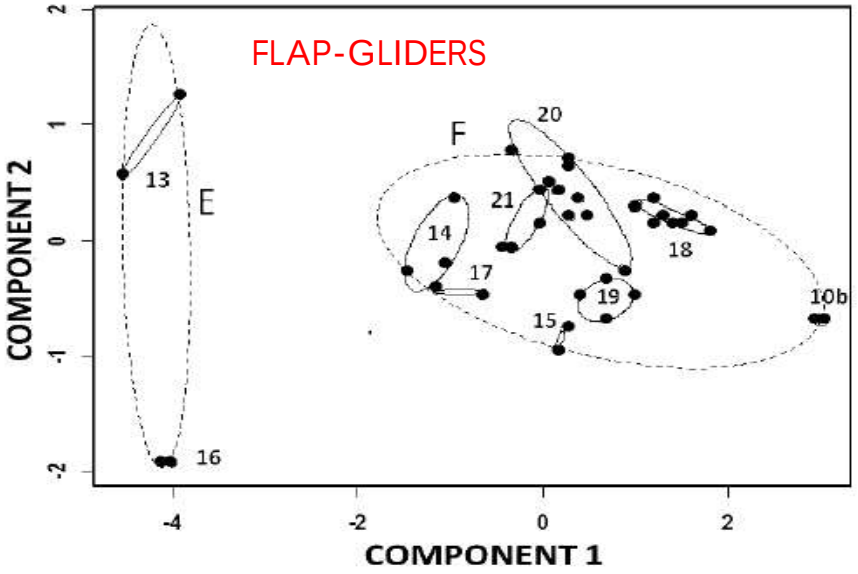
- **114 cruises**
- **1976–2006**
- **Covered 104 species** (virtually all in California Current)
- **Statistically meaningful**

Species Sort into Groups Based on Flight Characteristics





These are the divers, scoters, eiders and geese that are prominent in European studies



Ainley, D.G., E. Porzig, D. Zajanc & L.B. Spear. 2015. Seabird flight behavior and height in response to altered wind strength and direction. Marine Ornithology 43: 25-36.

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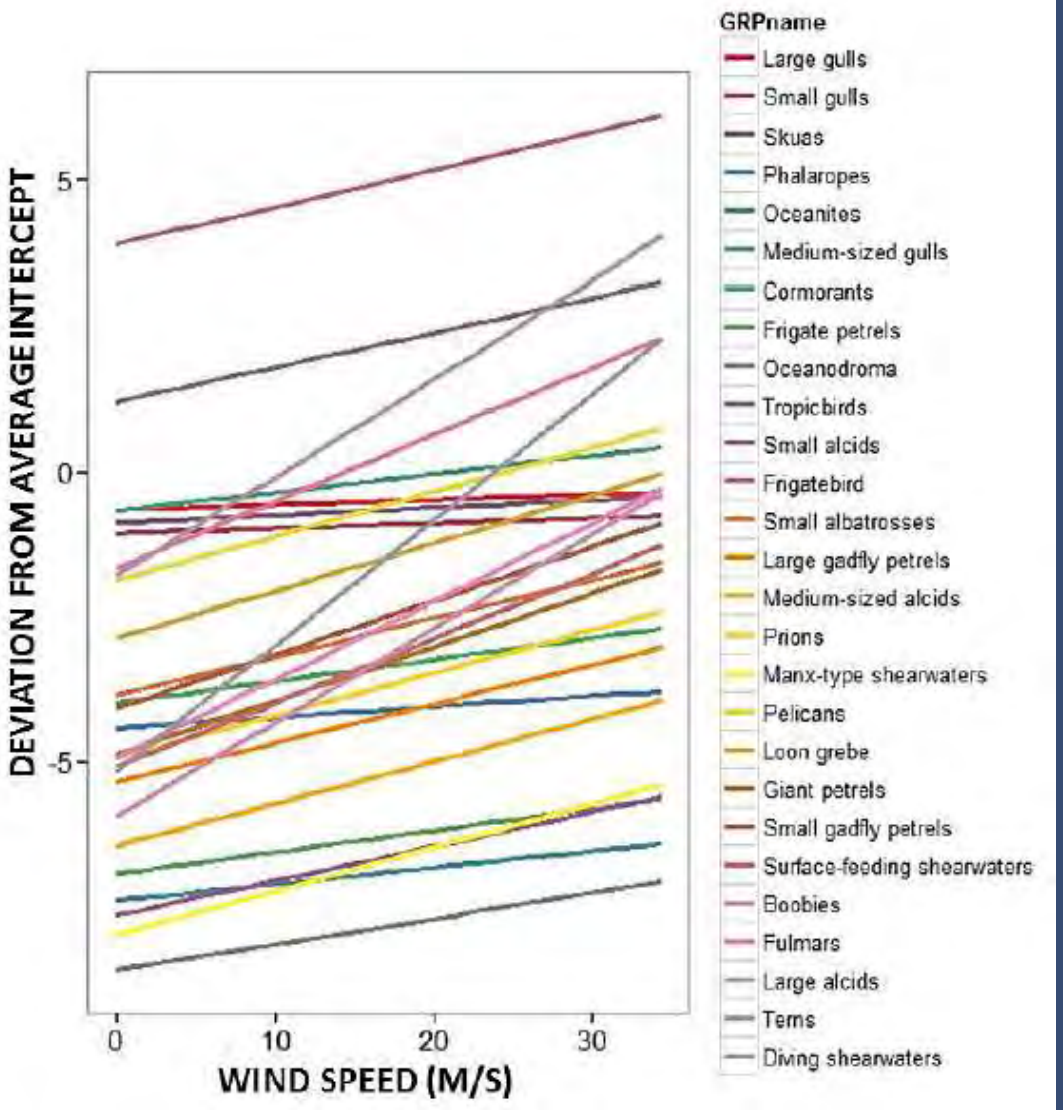
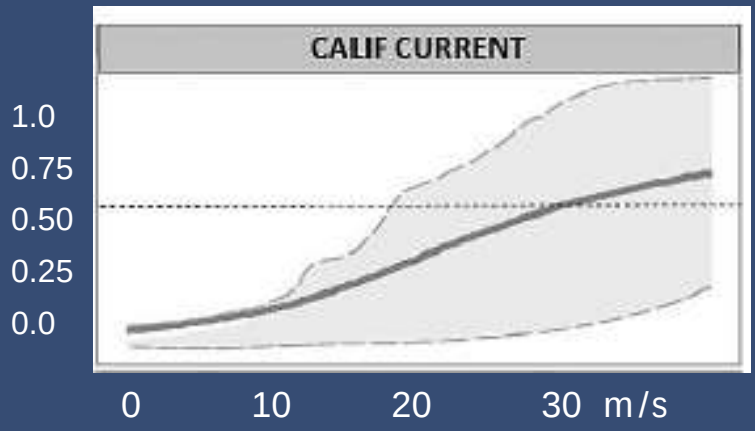
Responses to Increased Wind Speed



Some flight style groups change flight height more readily as wind speed increases (albatross, petrel, and shearwater)



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

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Ainley, D., et al. Marine Ornithology 43: 25-36.

Responses to Increased 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

Ainley, D., et al. Marine Ornithology 43: 25-36.

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

- More flapping (more maneuverable)
- Less flapping, more gliding (less maneuverable)

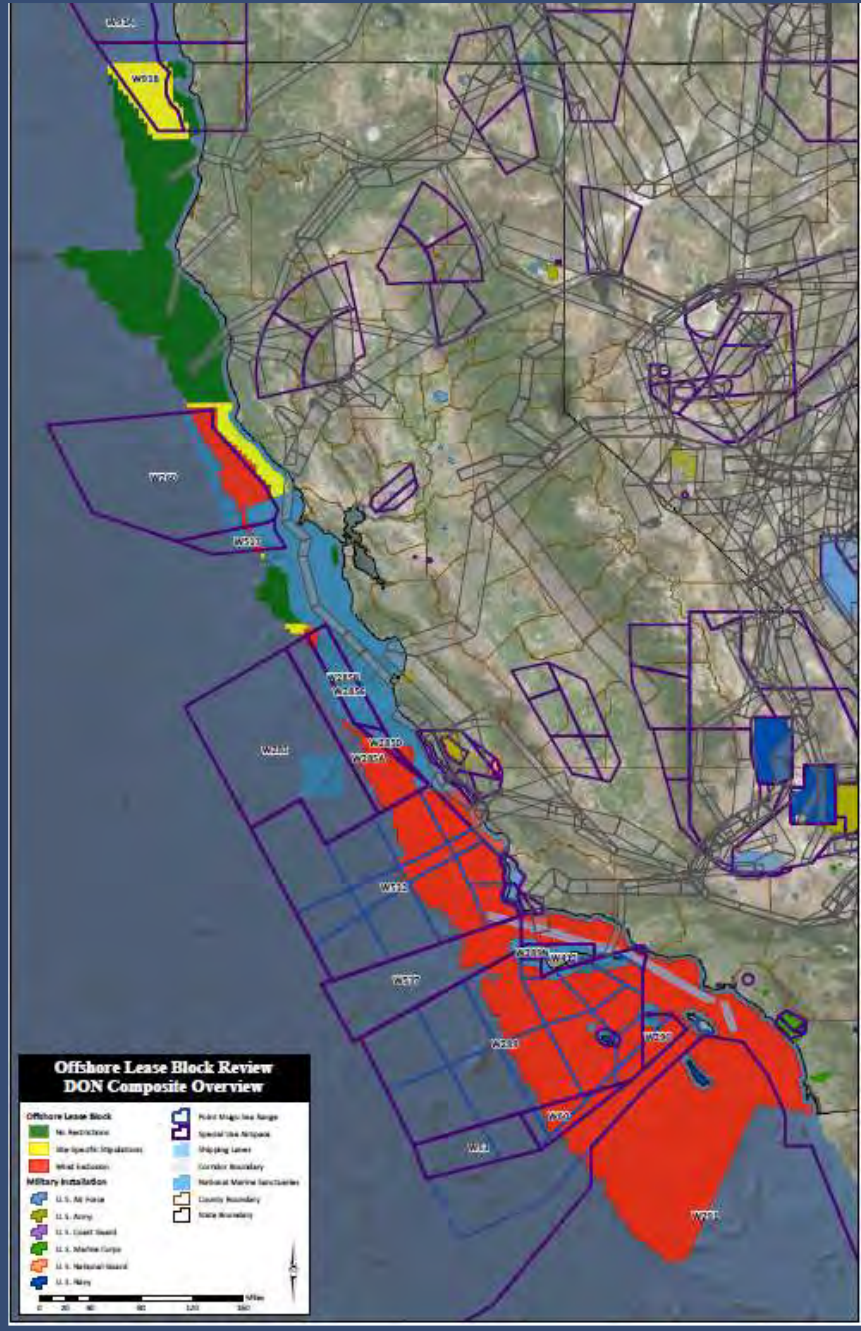
Maneuverable species pretty much fly around obstructions regardless of wind speed (e.g., species that use flapping flight).

Recommended Next Steps

- **Derive 3D picture of seabird presence as a function of the coastal wind regime and seabird behavior. This will provide insight on:**
  - where offshore wind facilities might have repercussions that public would not support
  - where offshore wind facilities might be feasible

Monitoring

- **Monitoring will require detecting potentially rare collision encounters, under the usual 35-kt spring-summer winds.**
- **Remote locations and conditions at floating offshore wind project sites will increase monitoring challenges.**



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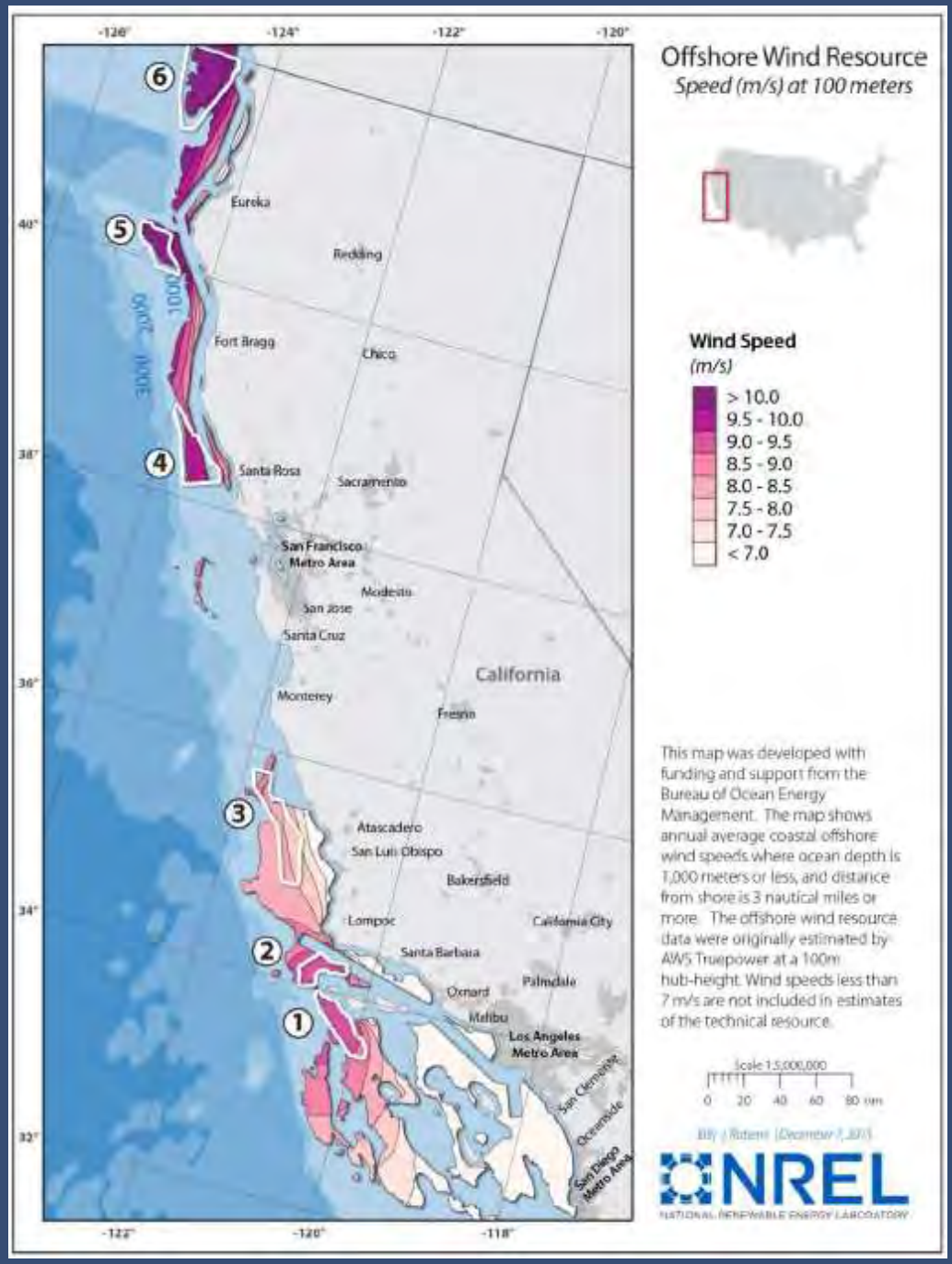
https://tethys.pnnl.gov/publications/west-coast-environmental-protocols-framework-baseline-and-monitoring-studies

http://greenfleet.dodlive.mil/files/2017/08/DON-Composite_CA-Offshore_8-JUN-2017-1.pdf

Monitoring

Methodologies used to monitor and validate collision models for terrestrial wind (e.g., carcass searches) will not work for evaluating offshore wind.



https://www.nrel.gov/docs/fy17osti/67414.pdf

Monitoring

- **Traditional offshore monitoring methods such as boat-based or aerial monitoring will be expensive and less effective at detecting rare events; also requires being at sea under normal 30-40-kt spring-summer winds.**

- **Telemetry would be a potential approach; however, it's problematic due to low numbers of animals/small sample sizes.**

Monitoring Considerations

- **Need for platform stability**
- **Scale**
- **Data streams**
- **Level of detection required (e.g., species identification)**

New Monitoring Technologies

- **Technologies under development that show promise include:**
  - Radar (horizontal and vertical)
  - Optical (visual, thermal imagery)
  - Acoustic
  - Accelerometers (vibration sensors)
- **Considerations**
  - Need for platform stability
  - Scale
  - Data streams
  - Level of detection required (e.g., species identification)

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Thank You!

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For additional information about the California Offshore Renewables Environmental Regulatory Workshop organized by the Pacific Ocean Energy Trust in Sacramento on March 14, 2018 and to access additional presentations go to:
http://pacificoceanenergy.org/california-offshore-renewables-environmental-regulatory-workshop/