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# Avian Considerations and Offshore Wind in the California Current


**Presented by Scott Terrill, PhD, Principal and Avian Ecologist, H. T. Harvey & Associates**

**to the California Energy Commission**

**Staff Workshop Next Generation Wind Energy Technologies and their Environmental Implications**

**October 25, 2018**

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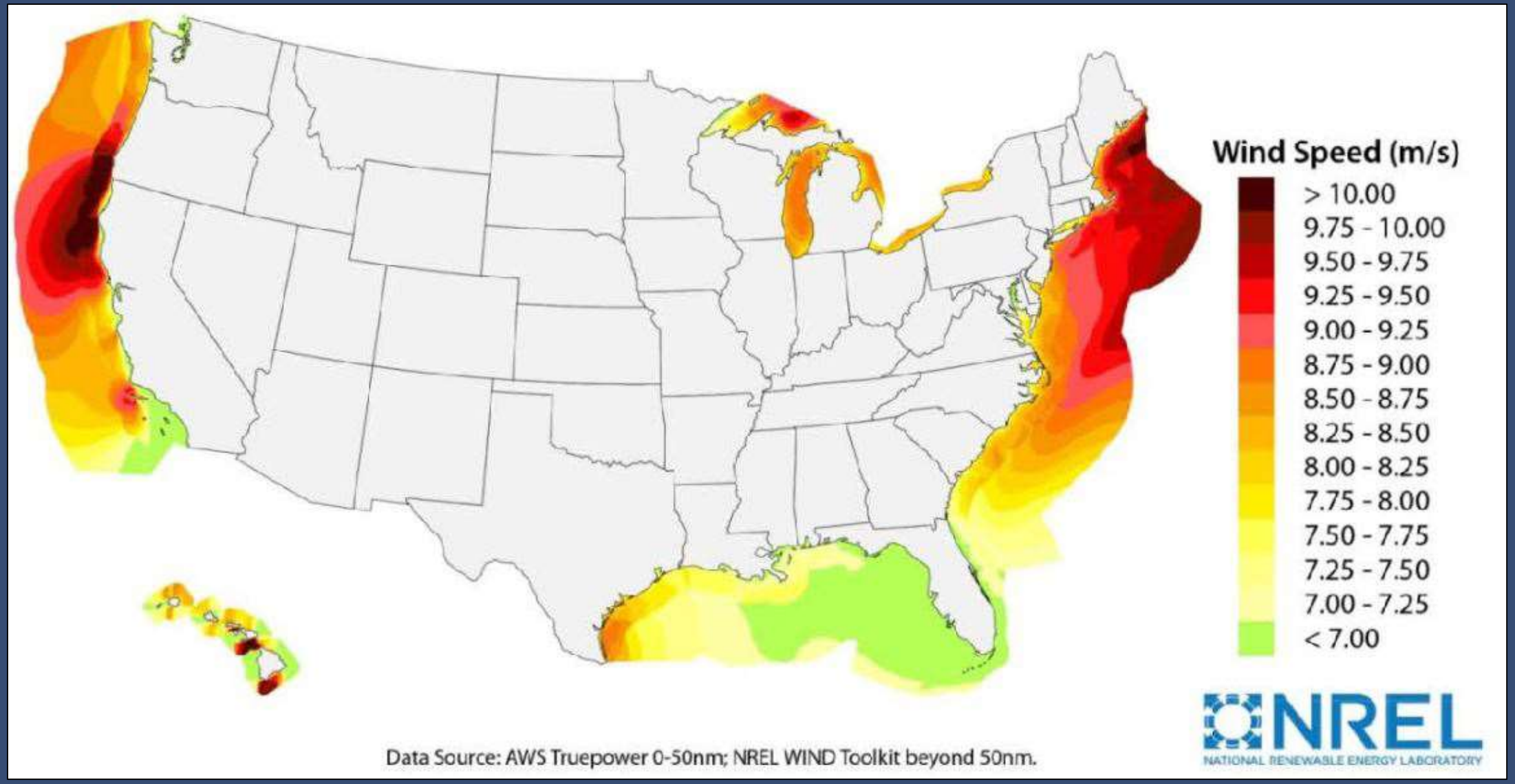
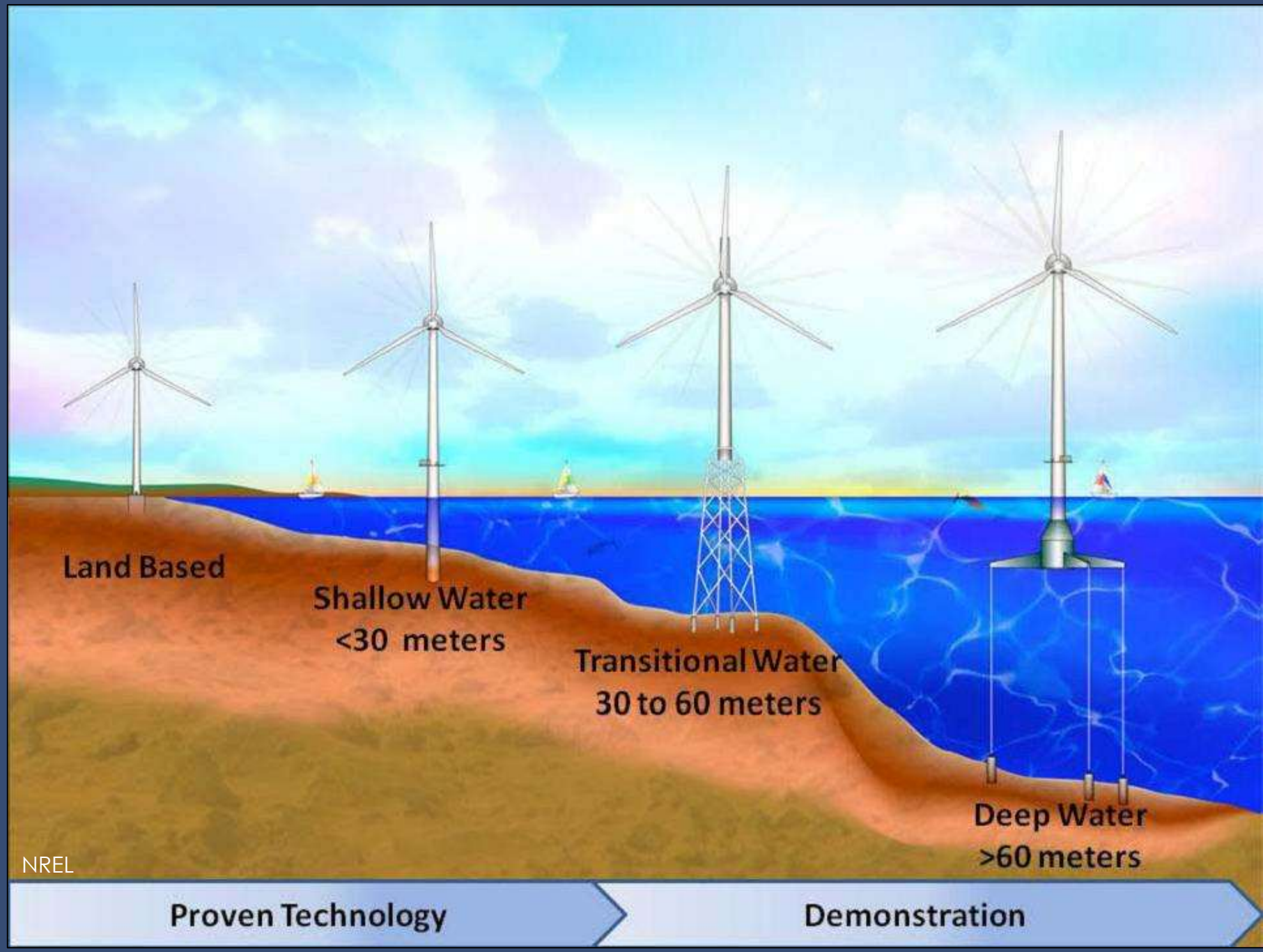
# Offshore Wind Energy Resource Map



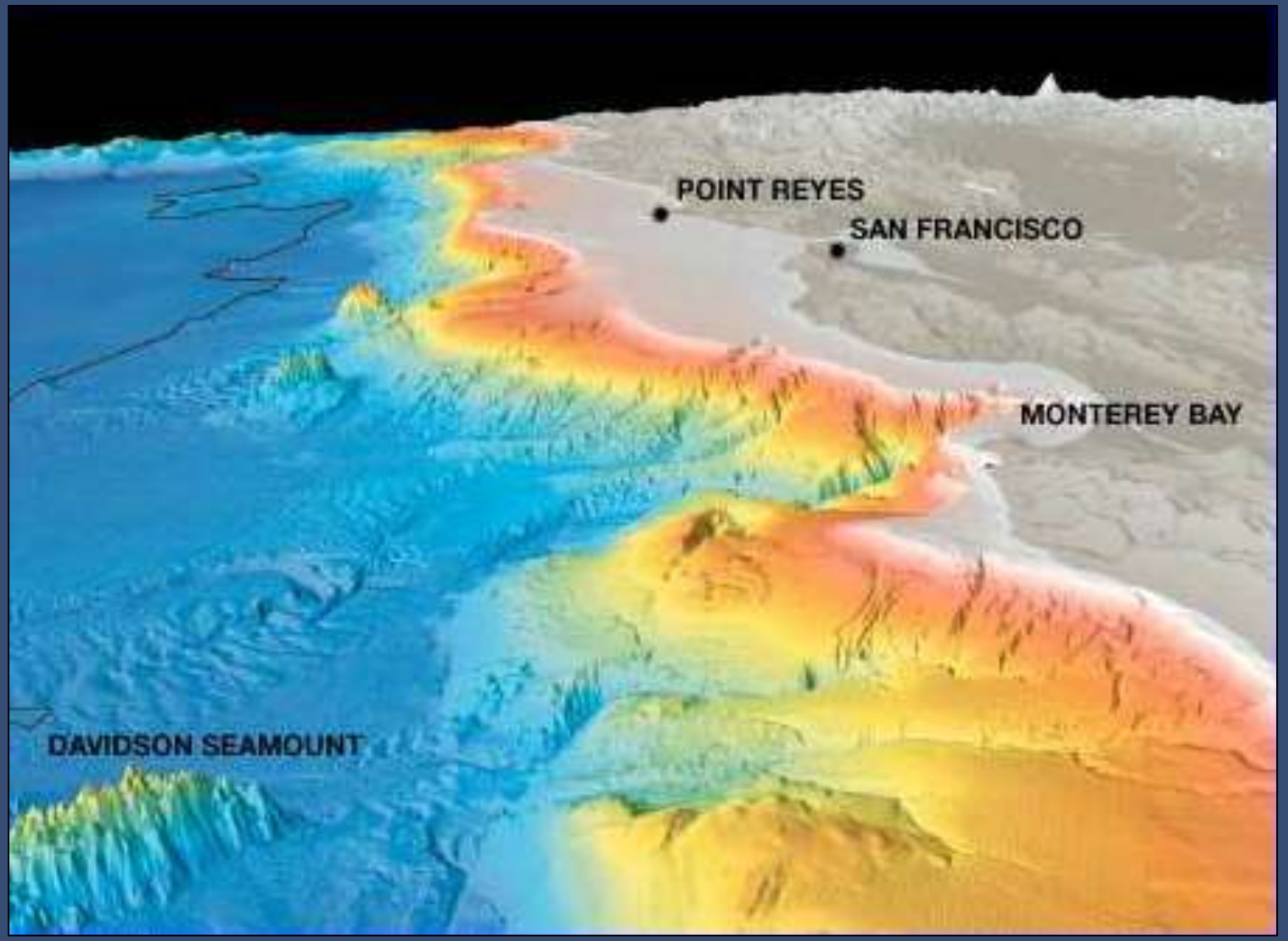
# Current Offshore Wind Projects (Europe, East Coast) are in Relatively Shallow Water

Projects off California are currently considering floating platforms in deep water.

Full-scale floating offshore wind turbines have been successfully deployed over multiple years and survived extreme conditions (e.g., waves > 17m and winds > 60 knots).



# Outer Continental Shelf (OCS) off California Are Topographically Diverse, Drops off Rapidly



# Avian Considerations for Offshore Wind

## Marine Birds

- Collision
- Displacement
- Anthropogenic lighting


## Terrestrial Migrants Offshore

- Collision
- Anthropogenic lighting

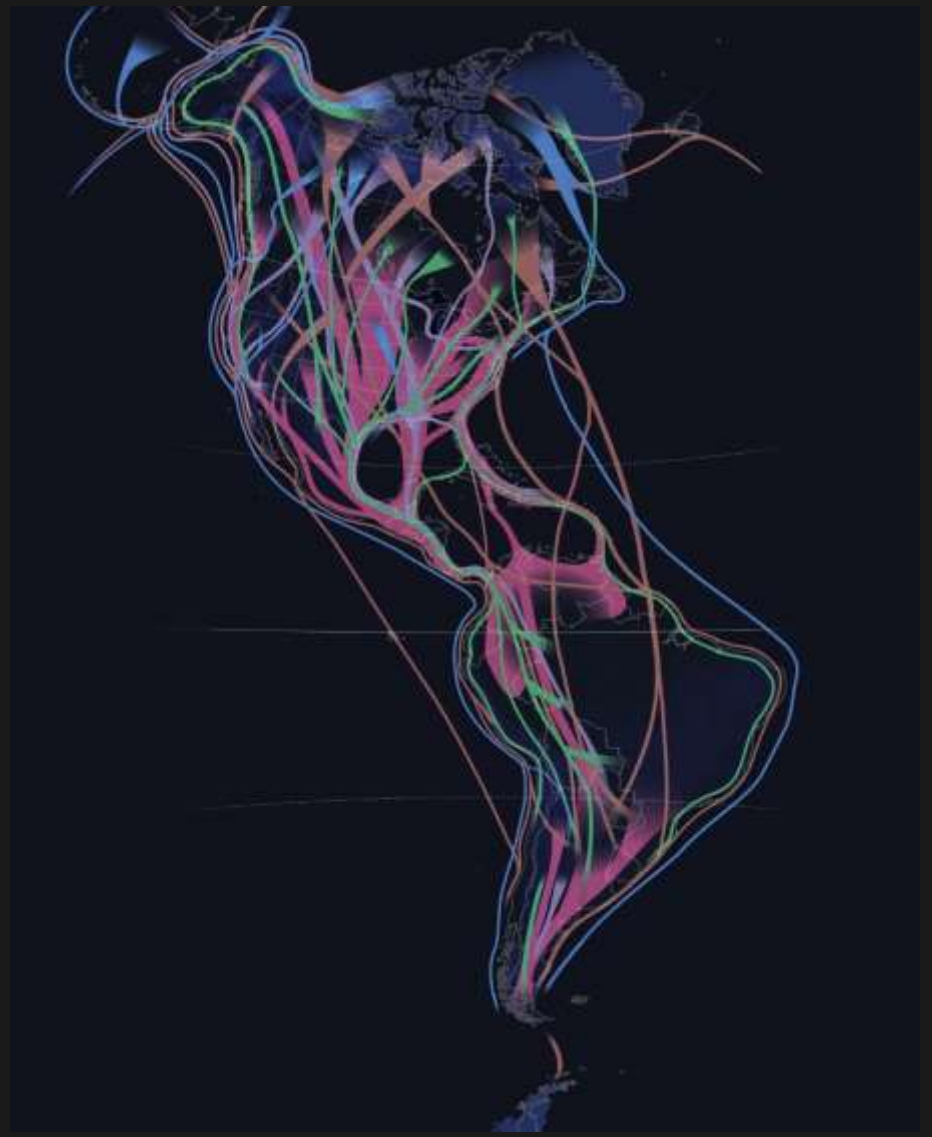
# Migrant Terrestrial Birds

- **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, 1959©

# Landbird Migration Patterns in California

- Due to the northwest to southeast migration of landbirds, they do not "want" to migrate offshore of the west coast of the United States
- Disoriented migrants and "drifting" migrants wind up offshore, but it is relatively rare event and typically weather dependent
- Probably not a major issue off California, at least not far offshore



National Geographic

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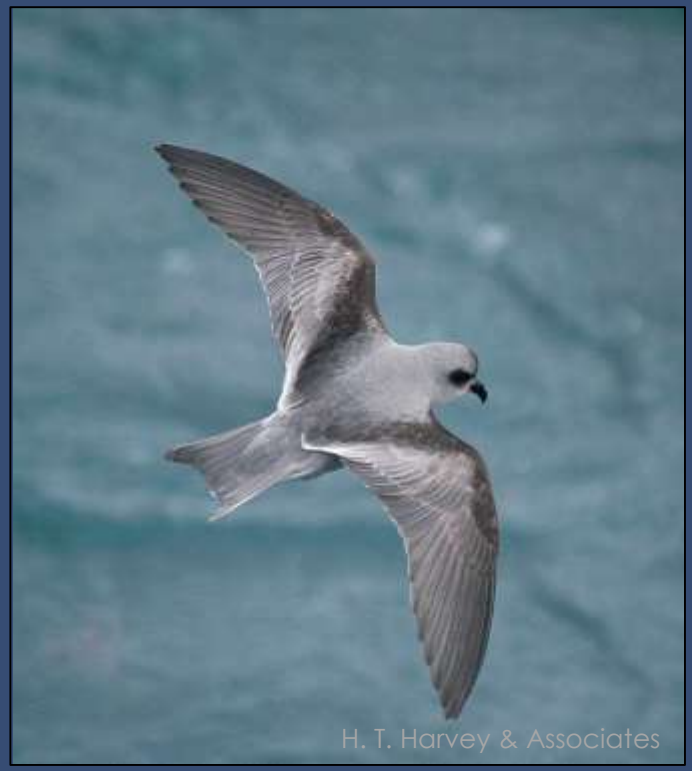
# General Considerations for Seabirds


- Collision
- Displacement
- Habitat loss
- Lighting
- Spills





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# Many Studies and Monitoring Efforts in the Atlantic

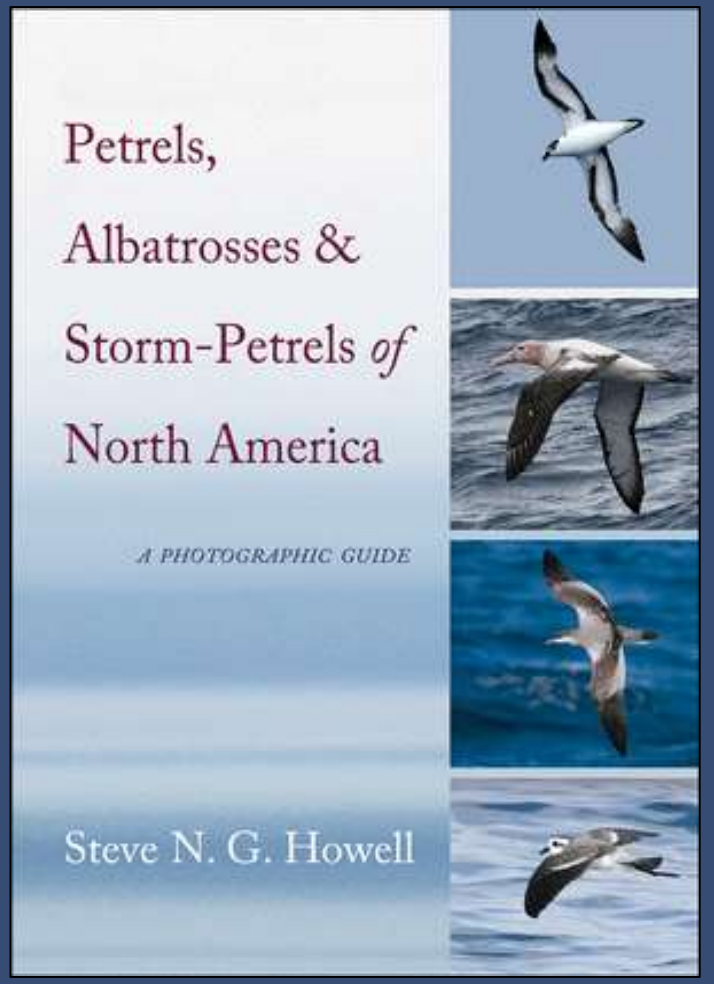
- Some of the results with similar species groups in both oceans, may be extrapolated to Pacific–especially nearshore–but are not applicable for many species in the California Current, especially over the outer continental shelf.
- Major species differences in the Pacific are even more pronounced off the outer continental shelf.

# 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, and petrels(whose flight behavior and flight height is especially sensitive to wind strength)*
- **Narrow continental shelf means oceanic species are closer to coast**



# Nearshore Atlantic vs. Offshore Pacific



Offshore "gliders" tend to fly low to the water but arc up high above the water during windy conditions


Nearshore "flappers" tend to fly low to the water, except at times during migration - are less subject to wind


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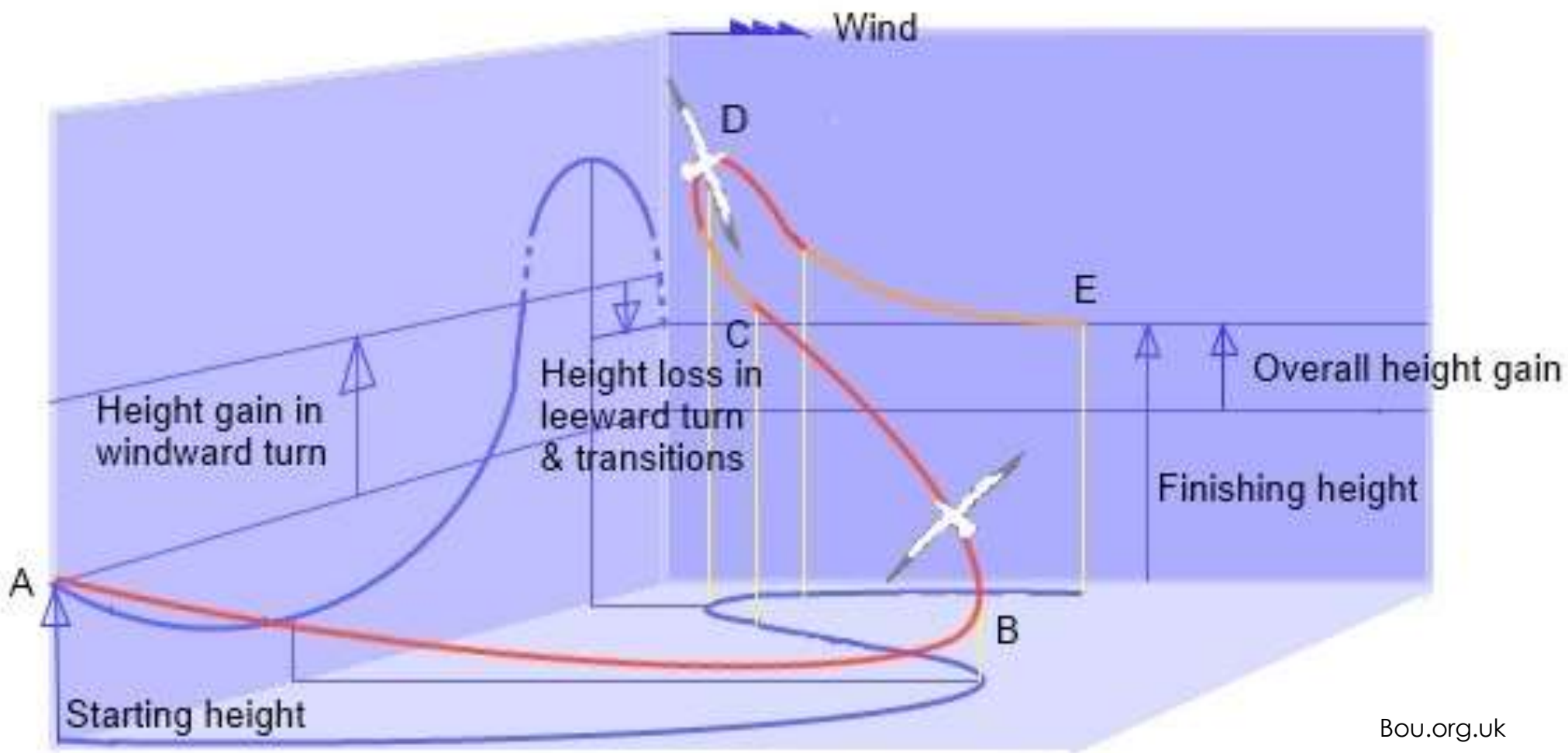
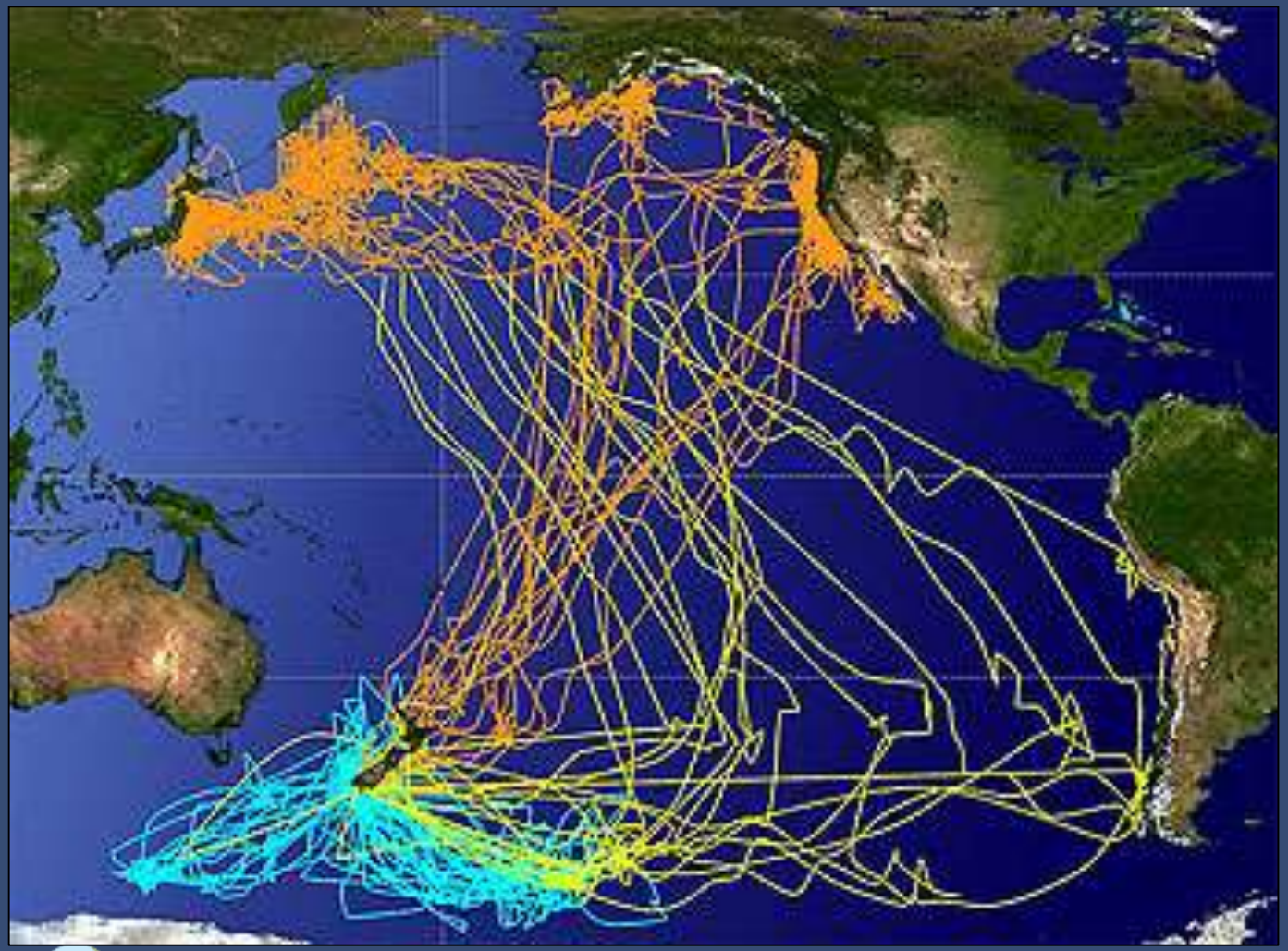
Figure 1
The Dynamic Soaring Manoeuvre




Bou.org.uk

# Many Species Migrate to the California Current



ucsc.edu

Tgreybirds.com

# Potential Avian Research Priorities for Offshore Wind Projects off California

## 1) Risk Modelling

Modeling could indicate areas of higher potential risk to seabirds relative to other areas off California. For the California Current, copious data are available on seabird occurrence, density hotspots, and flight behavior as a function of wind speed*.

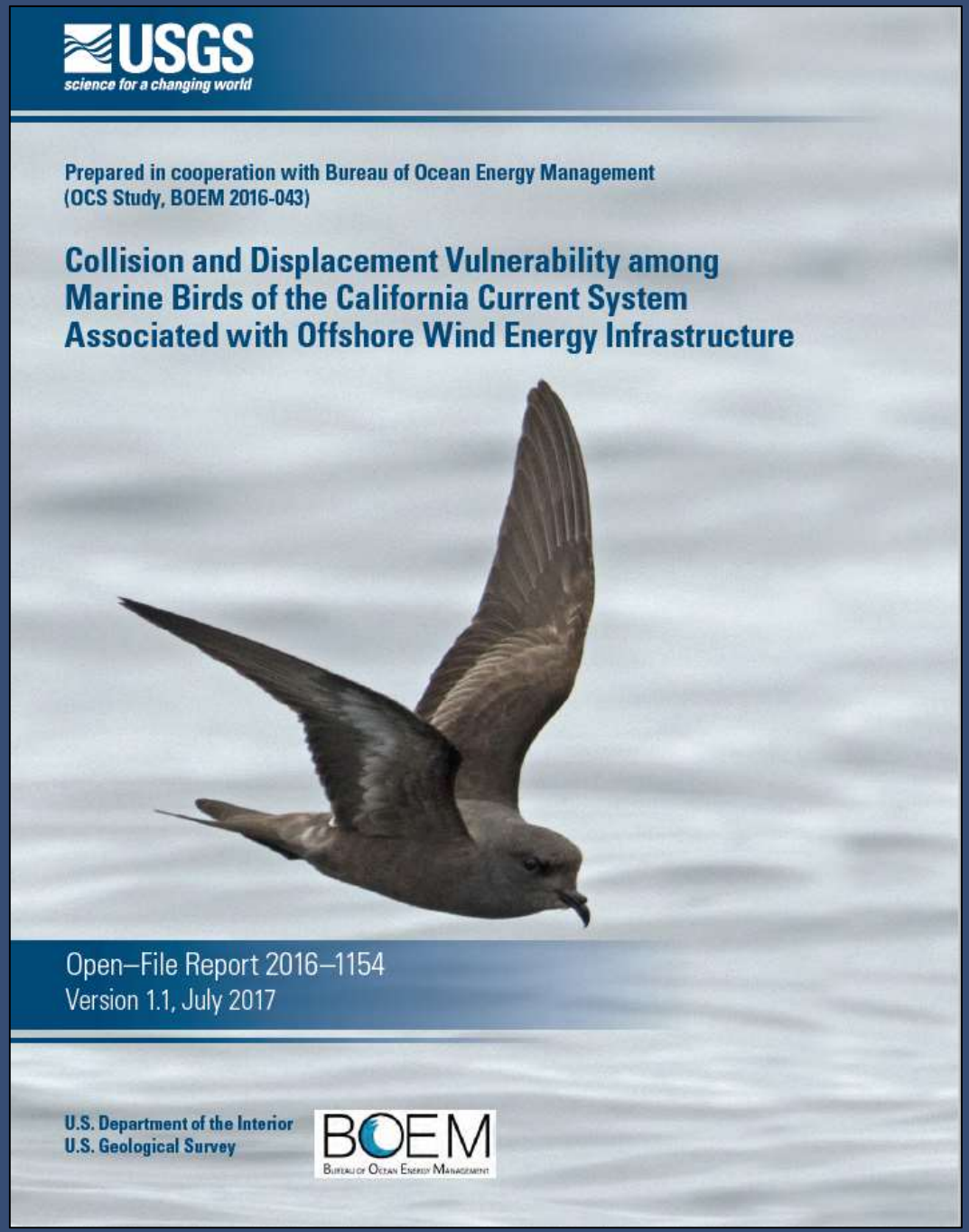
## 2) Remote Monitoring Instrumentation Packages

- Monitoring potential impacts is a challenge over the OCS off California.
- Boat-based monitoring represents a logistic challenge and is expensive, plus it's very difficult to detect avian collisions at sea.
- Technologies are currently being developed for remote monitoring of offshore wind sites and projects. They are in the development stage.



*Ainley, et al. Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction. Journal of Marine Ornithology, 43: 25–36 (2015)

- **Avian vulnerability to offshore wind has been modelled for the California Current**
  - Population vulnerability
  - Collision vulnerability
  - Population displacement vulnerability
- **Next step could be region wide or specific-site risk modelling using**
  - Species distribution and abundance
  - Flight height data as a function of wind speed and direction
  - The "windscape" in area under consideration



# 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

# Monitoring

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

# New Monitoring Instrumentation

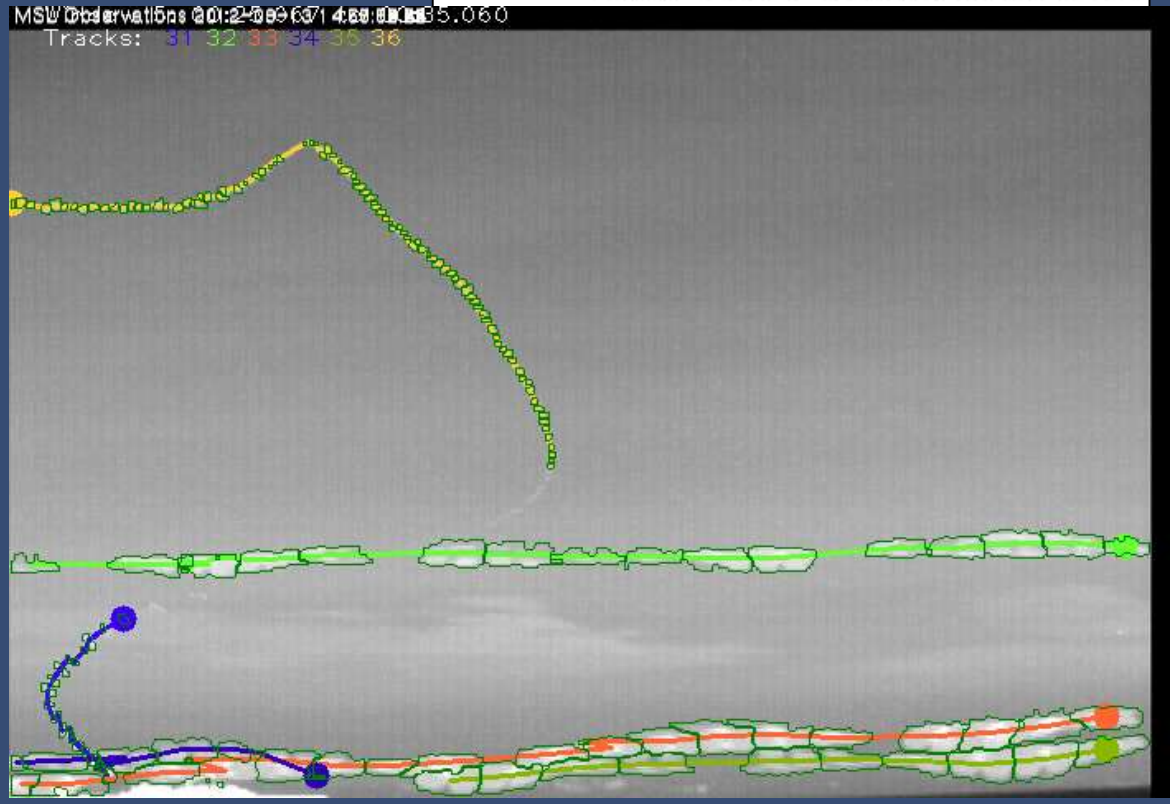
- **Instrumentation technologies under development that show promise include**
  - Radar (horizontal and vertical)
  - Optical (visual, thermal imagery)
  - Acoustic
  - Accelerometers (vibration sensors)
- **Considerations**
  - Platform stability Issues
  - Scale
  - Data streams
  - Level of detection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

# Monitoring Instrumentation

## Thermal Tracker: Avian remote sensing for offshore wind

(Shari Matzner et al., Pacific Northwest National Laboratory)

- Thermal video enabling recording bird and bat activity both day and night and in low visibility conditions
- Automated processing delivers quantified passage rates and features for species classification
- Video exploits animal temperature contrast with background temperature to capture flight tracks

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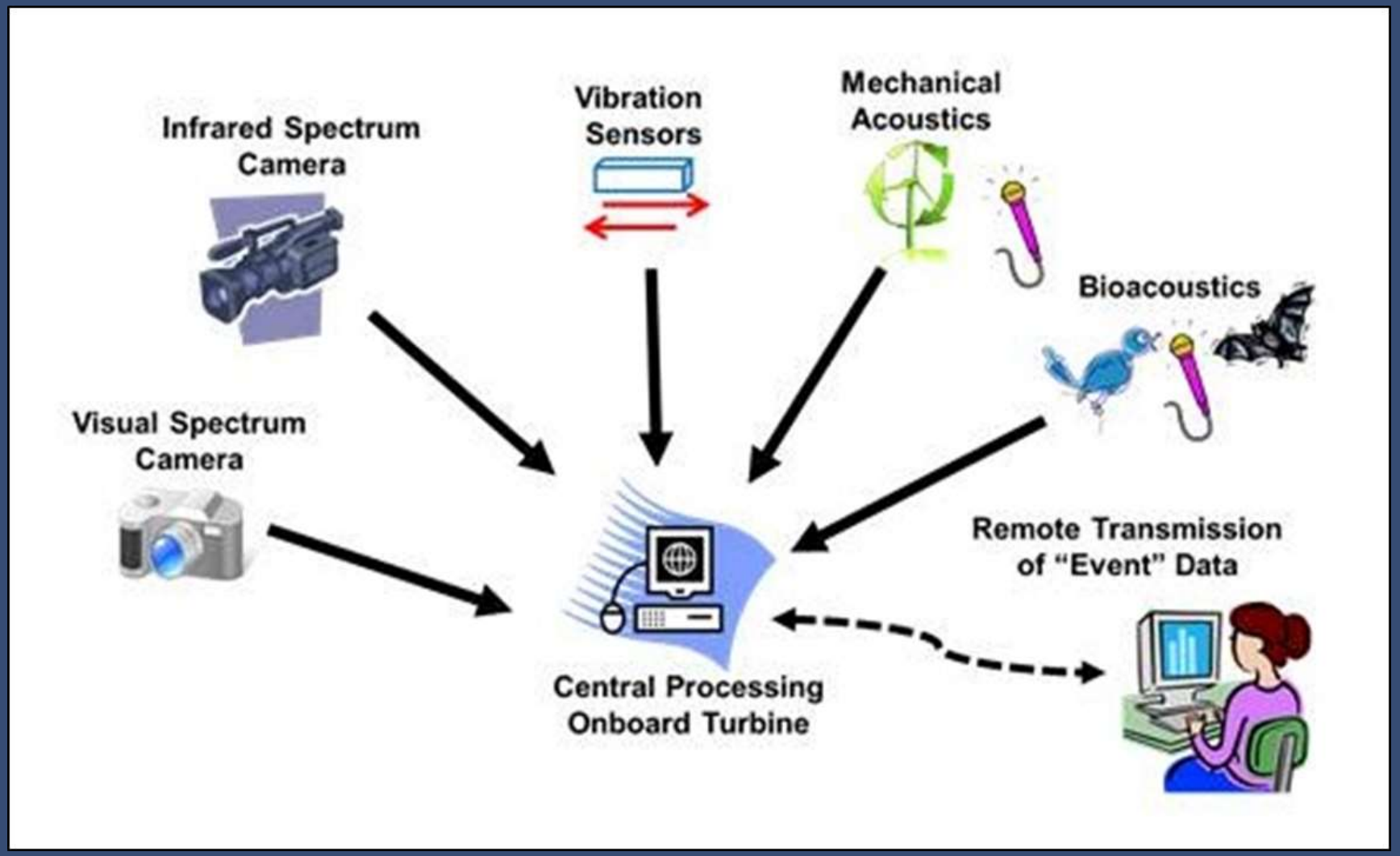
# Synchronized Sensor Array for Remote Monitoring

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# Thank you!

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