Seabird vulnerability to offshore wind energy infrastructure in the Pacific OCS

Western Ecological Research Center Seabird Program &
Bureau of Ocean Energy Management Environmental Pacific OCS Region

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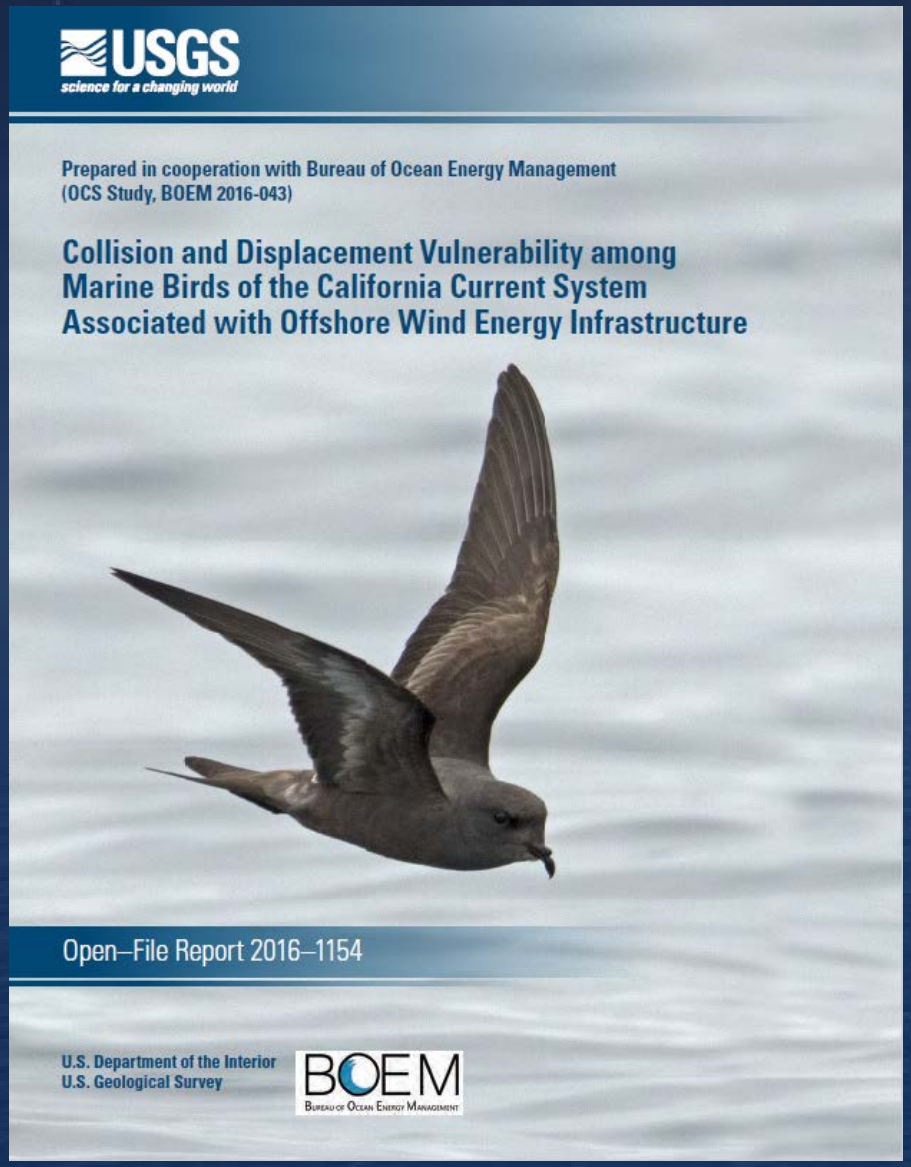
USGS science for a changing world

BOEM Bureau of Ocean Energy Management

Western Ecological Research Center



- USGS Ecosystem Mission Area
- Science support for BOEM
- First comprehensive vulnerability assessment
  - USGS open file report
- Tool to inform offshore wind energy planning in Pacific OCS

Why marine birds?

Marine birds and wind energy

Offshore wind energy infrastructure poses a threat

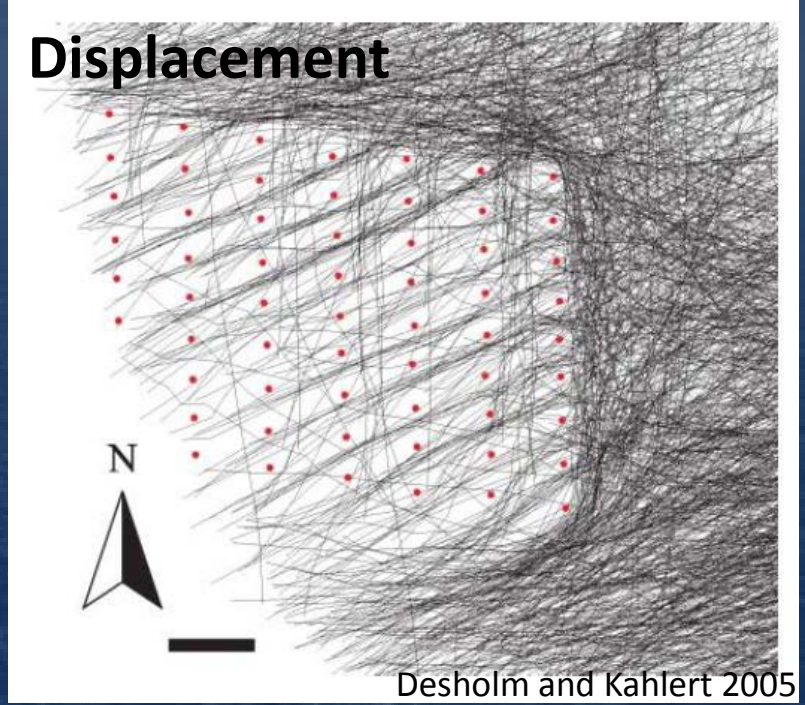
Purpose

Assess marine bird vulnerability to offshore wind farm development in Pacific OCS

Collision

Vanermen et al. 2013

Displacement



Desholm and Kahlert 2005

Calculating Vulnerability

Previous vulnerability indices
- European North Sea, US Atlantic

Seabird Survey records
- Pacific OCS species list

Comprehensive literature review
- Expert peer review
- Integrated uncertainty

Vulnerability Equations

Collision
- Diurnal and nocturnal flight activity
- Time flying in rotor sweep zone
- Macro-avoidance

Population
- Global population size
- Percent of population in Pacific OCS
- Annual occurrence
- Threat ranking
- Adult survival
- Breeding score

Displacement
- Macro-avoidance
- Habitat flexibility

Population Collision Vulnerability

Population Displacement Vulnerability

Vulnerability Results

Alcids
Cormorants
Grebes
Gulls & Terns
Jaegers & Skuas
Loons
Pelicans
Phalaropes
Procellariids
Sea Ducks & Geese

BRPE
AWPE
SPSK
CATE
ELTE
LETE
FOTE
BRAC
ASSP
BOGU
WEGU
GBTE
STAL
BLSK
CAGU
HEEG
BFAL
ROYT
DCCO
THGU
RBGU
PECO
GWGU
ARTE
POJA
COTE
WEGR
PFSH
CLGR
COPE
PAJA
LTJA
LAAL
HADU
HAPE
SAGU
MUPE
BRAN
HERG
SUSC
BVSH
BLKI
REPH
BLTE
BLSP
MAMU
SCMU
MOPE
LSTP
SOSH
BLSC
MEGU
RBME
FTSP
FFSH
LESP
RHAU
RNGR
RNPH
NOFU
RTLO
COMU
WWSC
BULS
HOGR
CRMU
YBLO
TUPU
CAAU
MASH
PIGU
COME
COLO
EAGR
WISP
PALO
SRTS
LTDU
ANMU
HOPU
PAAU

Population Collision Vulnerability

300
200
100
0

0
50
100
150
200

Population Displacement Vulnerability

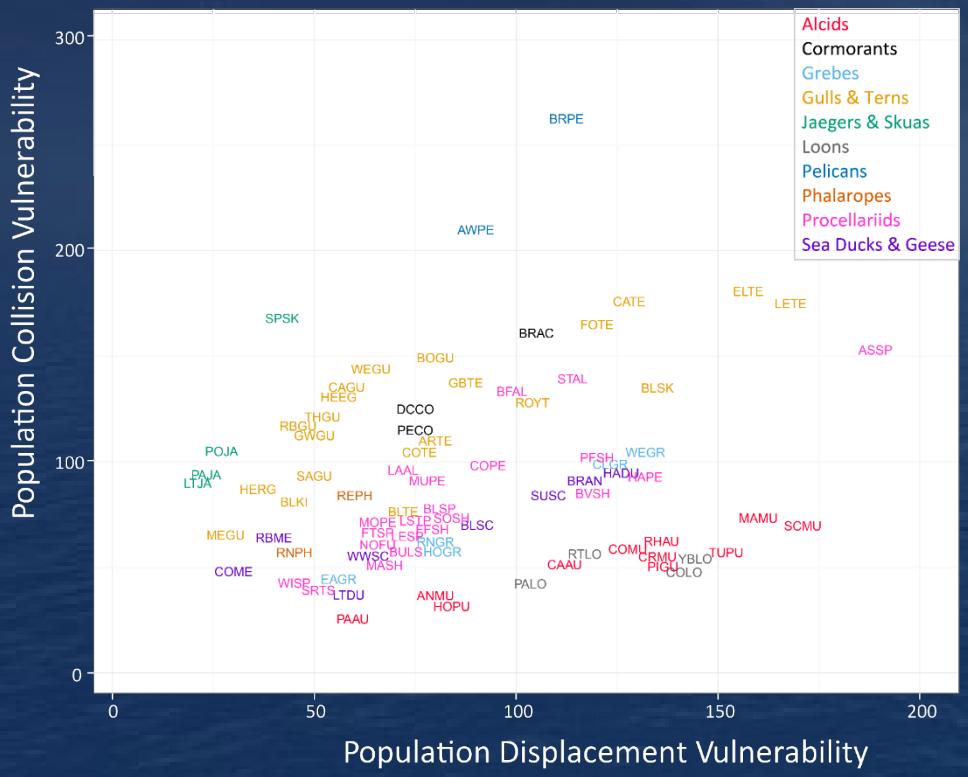
Vulnerability Discussion

- First comprehensive evaluation of marine bird vulnerability
- Vulnerability driven by species-specific parameters
- Uncertainty quantification
  - Opportunities to increase understanding
  - Database can be updated
- Useful tool for management decisions
- Vulnerability scores can be mapped using bird distributions to inform spatial planning

Mapping Vulnerability Example

Vulnerability applied to USGS at-sea survey data

PCV % rank * density % rank
PDV % rank * density % rank



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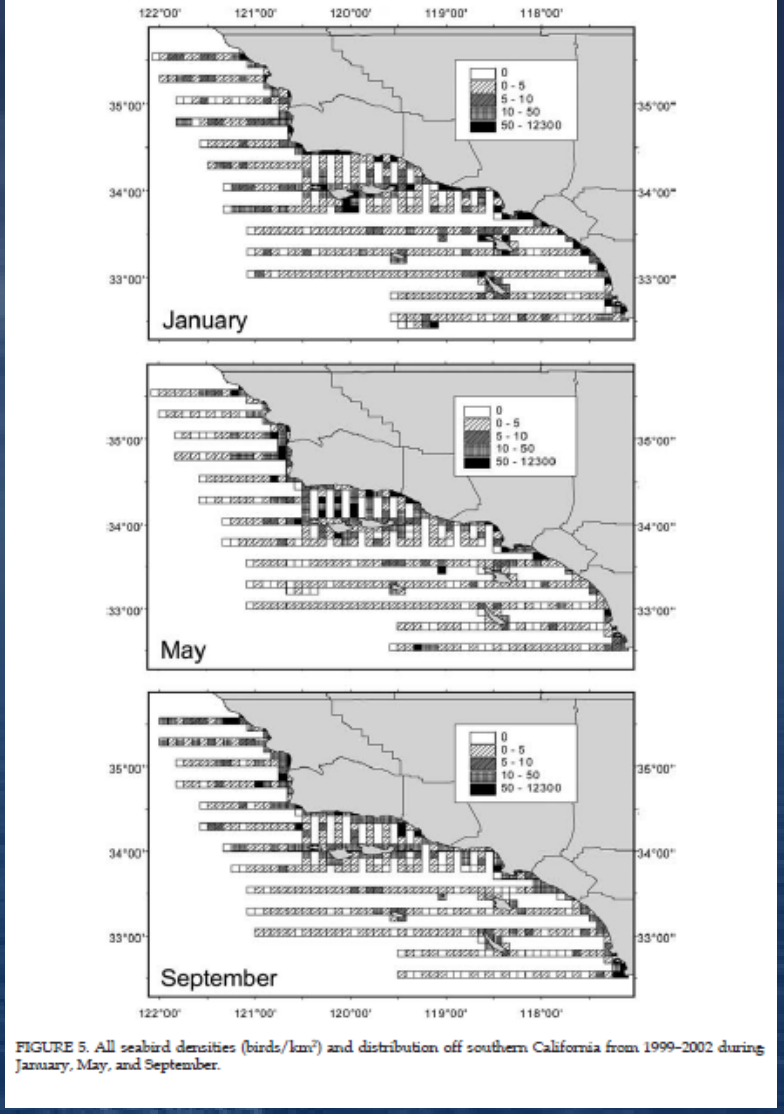
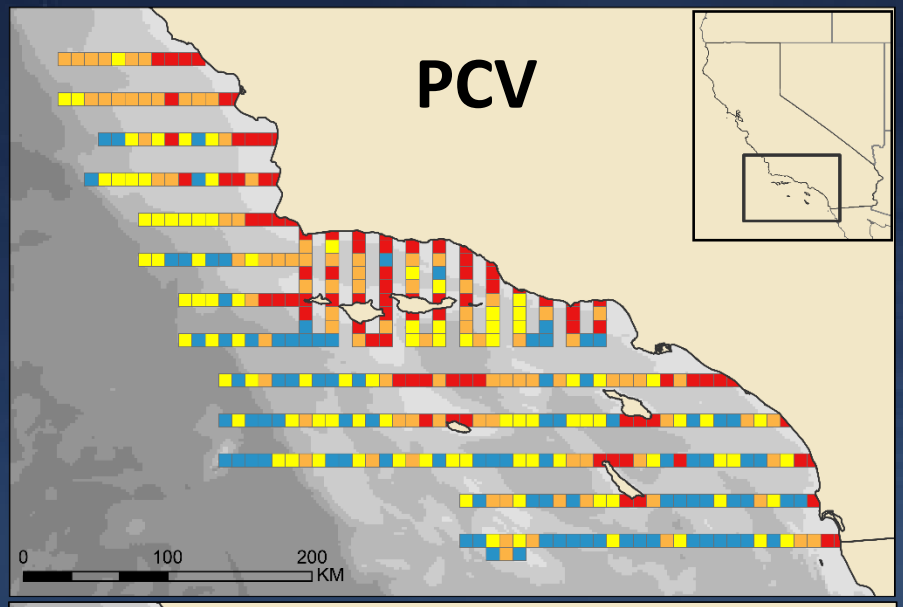
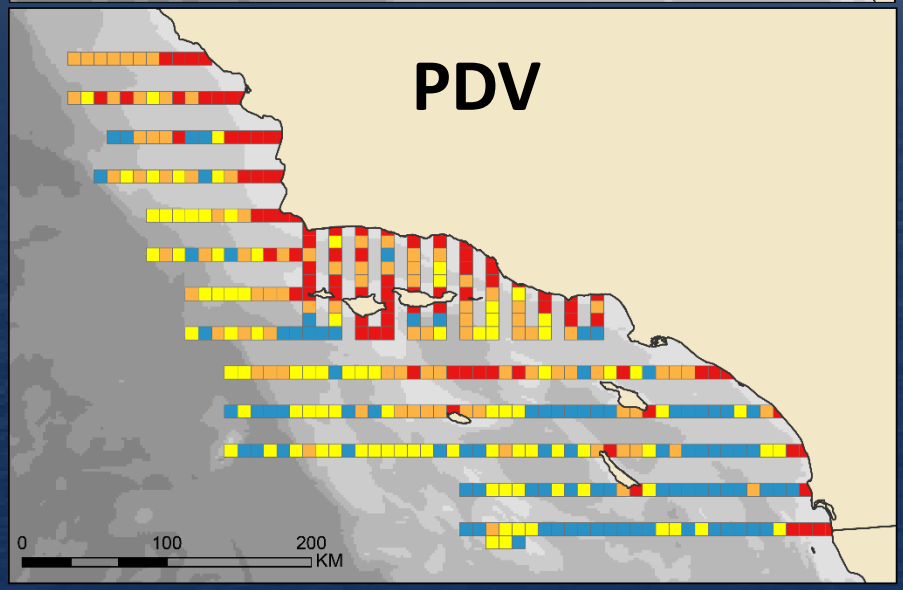


FIGURE 5. All seabird densities (birds/km²) and distribution off southern California from 1999–2002 during January, May, and September.

Mapping Vulnerability Example

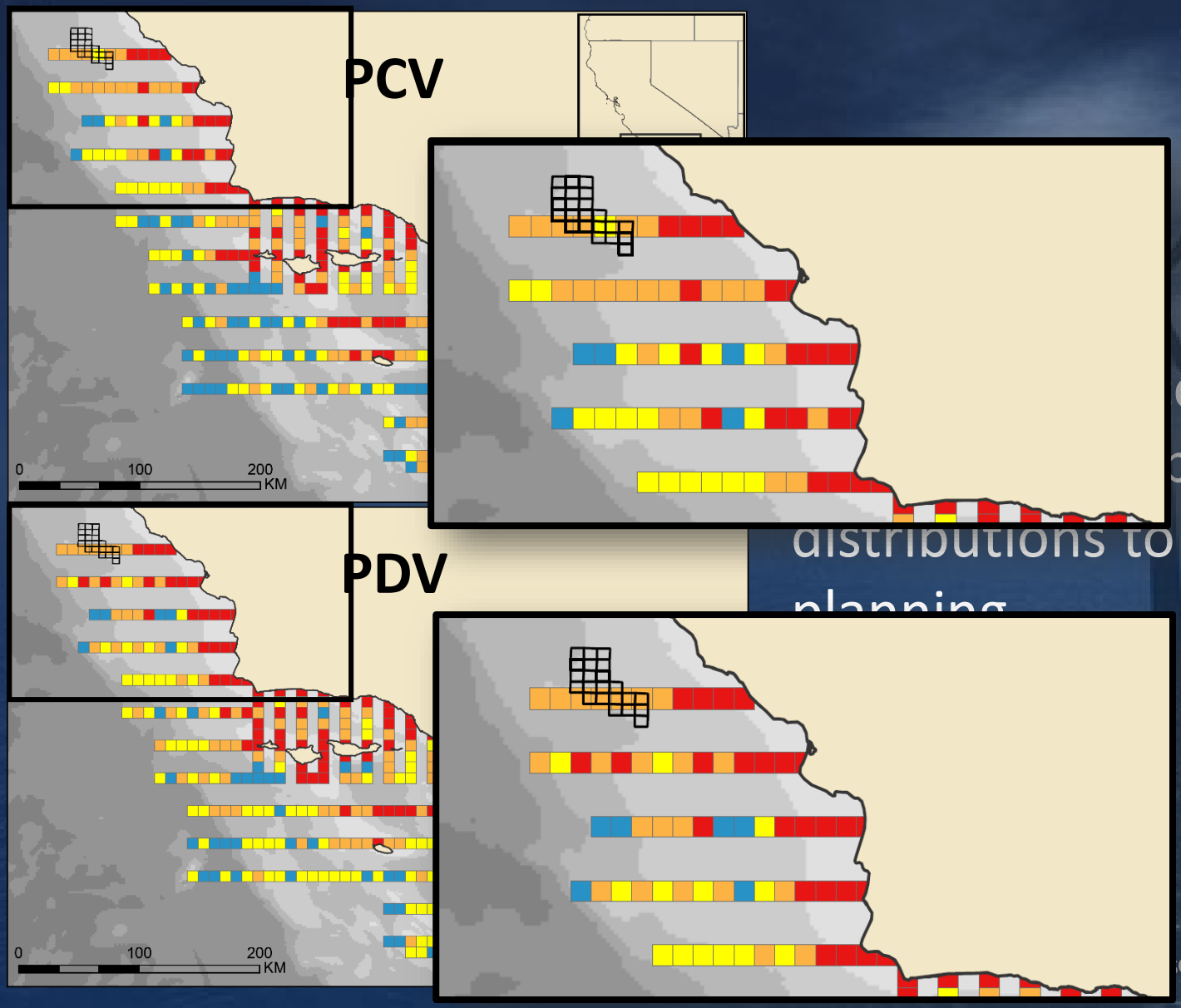




Colors indicate quantiles

- = 0 – 25%
- = 25 – 50%
- = 50 – 75%
- = 75 – 100%

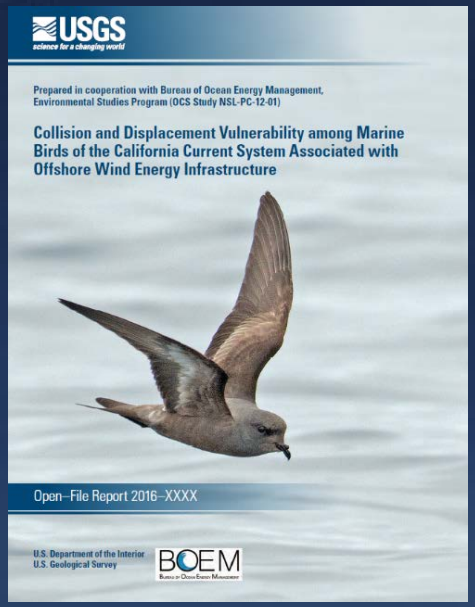
Mapping Vulnerability Example

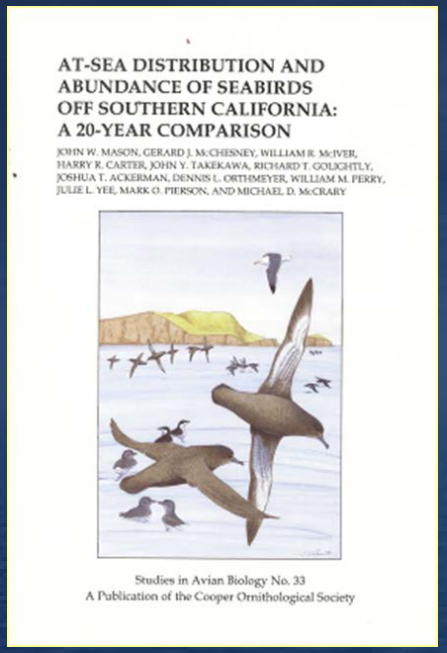


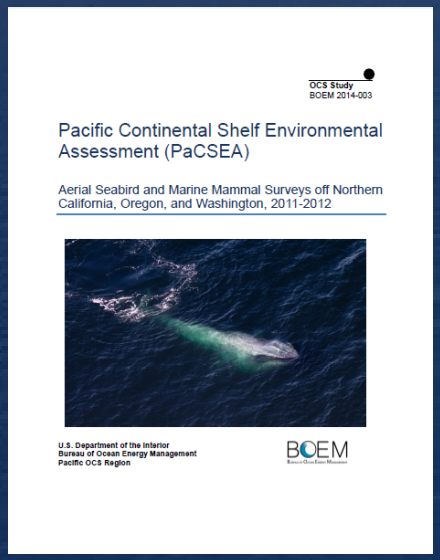
ores can be
bird
distributions to inform spatial
planning

olicited-OCS-Lease-Request/

Future Directions







- Maintain and improve database
- Vulnerability + aerial survey analysis for entire CCS
- Inform management decisions
  - Morro Bay
  - Future lease requests

http://www.werc.usgs.gov/Project.aspx?ProjectID=253

Thank You

- David Ainley
- Stefan Garthe, Helen Wade, Elizabeth Masden
- Julia Robinson Willmott, Greg Forcey, and Adam Kent

Questions?




Calculating Vulnerability

$$PV = (POP) + (CCSpop \times AO) + TR + (AS \times BR)$$

$$CV = \frac{(2 \times NFA) + DFA}{3} + RSZt + MA$$

$$DV = MA + HF$$

Population Collision Vulnerability =

PCV = CV x PV

Population Displacement Vulnerability =

PDV = DV x PV