Welcome to the BOEM-Oregon Science Exchange

May 18, 2016 - 10:00 am
Audio: call toll free 1-877-612-1641, passcode: 5729109
We will begin shortly!

If you are having technical difficulties, please call John Sanchez at 805-384-6315 or send us a chat message.

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Pacific Region Avian Biologist

David Pereksta

David Pereksta is the avian expert in BOEM's Pacific Region. Before coming to BOEM in 2010, he spent 16 years with the U.S. Fish and Wildlife Service working on the conservation and recovery of threatened and endangered species along the Pacific coast, and 3 years with the U.S. Forest Service surveying, monitoring and managing forest bird species in the Sierra Nevada. He has spent hundreds of days observing birds at sea off California, North Carolina, and Mexico and is a regular leader on pelagic bird trips in both the Pacific and the Atlantic. He has searched for birds throughout North, Central, and South America and has seen over 1,600 species of birds his travels; photographing over 1,000 of those species.

Today he will be presenting final results from a joint USGS/BOEM study on assessing the vulnerability of seabirds to renewable wind energy infrastructure in the California Current System.

Assessing the Vulnerability of Marine Birds to Renewable Energy Infrastructure in the California Current

David M. Pereksta

Bureau of Ocean Energy Management, Pacific OCS Region, Camarillo, CA

Josh Adams, Emma C. Kelsey, Jonathan Felis

U.S. Geological Survey, Western Ecological Research Center, Santa Cruz, CA

BOEM Oregon Science Exchange

May 18, 2016 • Camarillo, California

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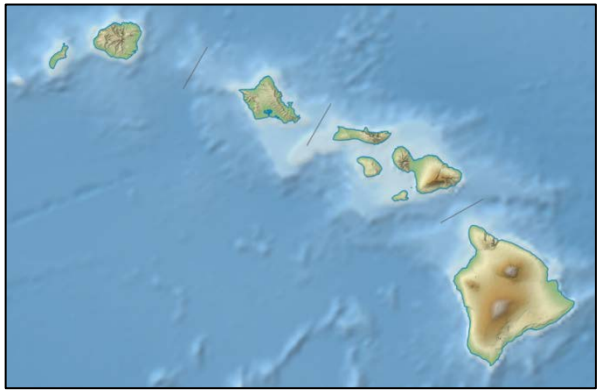
Pacific OCS Wind Energy

Oregon

- Unsolicited lease request in 2013
- WindFloat Pacific project off Coos Bay
- 24 MW from 3 floating 8 MW turbines



California

- Unsolicited lease request off Morro Bay
- 765 - 1,000 MW from 100 floating turbines
- Other companies evaluating projects

Hawaii

- 3 unsolicited lease requests off Oahu
- 400 MW each from 50 floating 8 MW turbines

Wind Energy Effects – Birds

Collision Hazard

- Rotor and support towers

Avoidance

- Displacement from feeding grounds
- Movement barriers
  - Migration and feeding

Attraction

- Prey base and habitat alteration/creation
- Light attraction/disorientation
- Perching - including falcons

Effects from one project could be minimal, but cumulative impacts from multiple projects could be significant

Information Needs for Renewable Energy

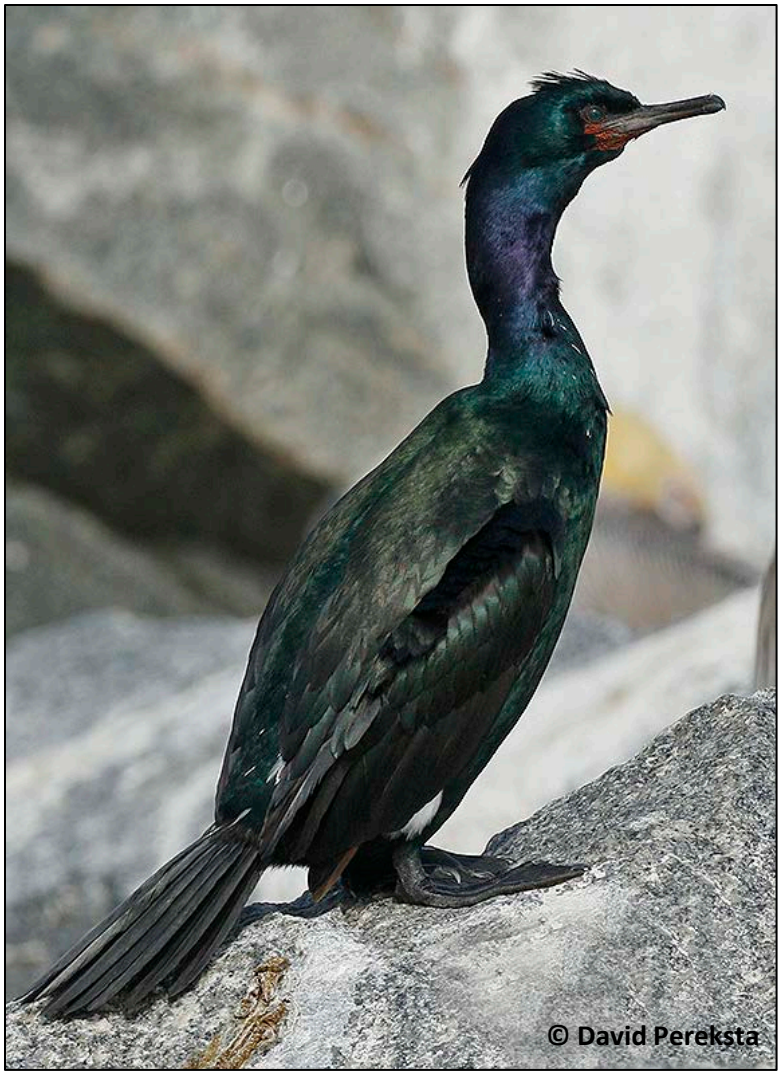
- Site-specific seasonal distribution and abundance – scale
- Seasonal density maps
  - Feeding, breeding, high use areas, migration routes, colony flight pathways
- Avoidance behavior
- Migration routes and patterns
  - Distance from shore, timing, passage height, each with weather/climate
- Energetic consequences
- Potential effects on prey
- Nocturnal activity and movement
- Effects of noise, lights and structures; collision risk

Study Objectives

Objectives

- Support the analysis of seabird flight behavior to inform the design, operations, and siting of offshore renewable energy projects
- Develop a seabird sensitivity index for wind projects on the Pacific OCS
- Summarize seabird vulnerability on digital maps
- Apply the index to offshore renewable energy development sites
- Develop levels of concerns that could act as a basis for selection of offshore renewable energy sites

Background



Vulnerability Assessments

- Similar assessments developed in Europe and the Atlantic
  - Garthe and Huppop 2004
  - Desholm 2009
  - Furness et al. 2013
  - Willmott et al. 2013
- Marine bird vulnerability assessments
  - Natural history and demography
  - Flight heights and flight styles
  - Avoidance behavior

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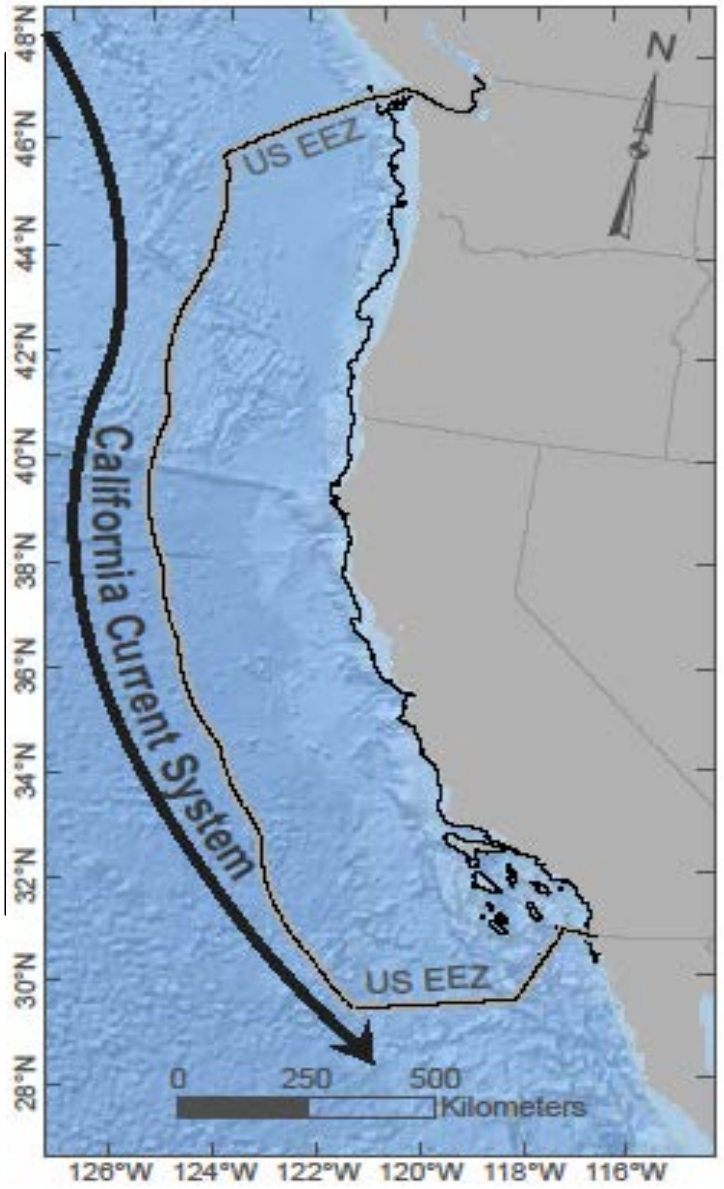
Developing a Vulnerability Index

Overview

- Assess marine bird vulnerability to offshore wind development in the CCS
- Comprehensive seabird vulnerability database for CCS species
  - 62 seabirds
  - 19 marine waterbirds
- Analyze data on flight height as a function of wind speed and species
- Analyzed factors of **Displacement** and **Collision** Vulnerability, as a function of **Population** Vulnerability
- Idea initiated by BOEM
- Funded and developed in partnership with USGS



Vulnerability Metrics

Population Vulnerability

- POP = Global Population Size
- CCSpop = Proportion of POP in CCS
- TS = Threat Status
  - IUCN, country, and state rankings
- AS = Adult Survival
  - High ranking = higher survival rate
  - Low ranking = lower survival rate
- BR = Breeding Score
  - Weighting factor for AS
- AO = Annual Occurrence
  - Number of months species found in CCS

Vulnerability Metrics

Collision Vulnerability

- DFA = Diurnal Flight Activity
- NFA = Nocturnal Flight Activity
  - More time = higher value
- MA = Macro-Avoidance
  - High avoidance = low collision risk
- RSZt = % time flying at height of Rotor Swept Zone
  - More time = lower value

Displacement Vulnerability

- MA = Macro-Avoidance
  - High avoidance = high displacement risk
- HF = Habitat Flexibility
  - High Value = Specialized Forager
  - Low Value = Opportunistic Forager

Calculating Vulnerability

Population Vulnerability

PV = POP + (AO x CCSpop) + TS + (BR x AS)

- Metric Values: 1-5
- AO and BR scaled 1-2
- Pink-footed Shearwater = 5 + (1.5 x 4) + 4 + (1 x 5) = **20**

Calculating Vulnerability

Collision Vulnerability

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

- Metric Values: 1-5
- Pink-footed Shearwater = $\frac{(2 \times 3) + 3}{3} + 1 + 1 = \mathbf{5}$

Calculating Vulnerability

Displacement Vulnerability

DV = MA + HF

- Metric Values: 1-5
- Pink-footed Shearwater = 5 + 1 = **6**

Calculating Vulnerability

Pink-footed Shearwater

- Population Vulnerability = 20
- Collision Vulnerability = 5
- Displacement Vulnerability = 6

Population Collision Vulnerability = CV x PV

- PCV = 100
- Rank - HIGH

Population Displacement Vulnerability = DV x PV

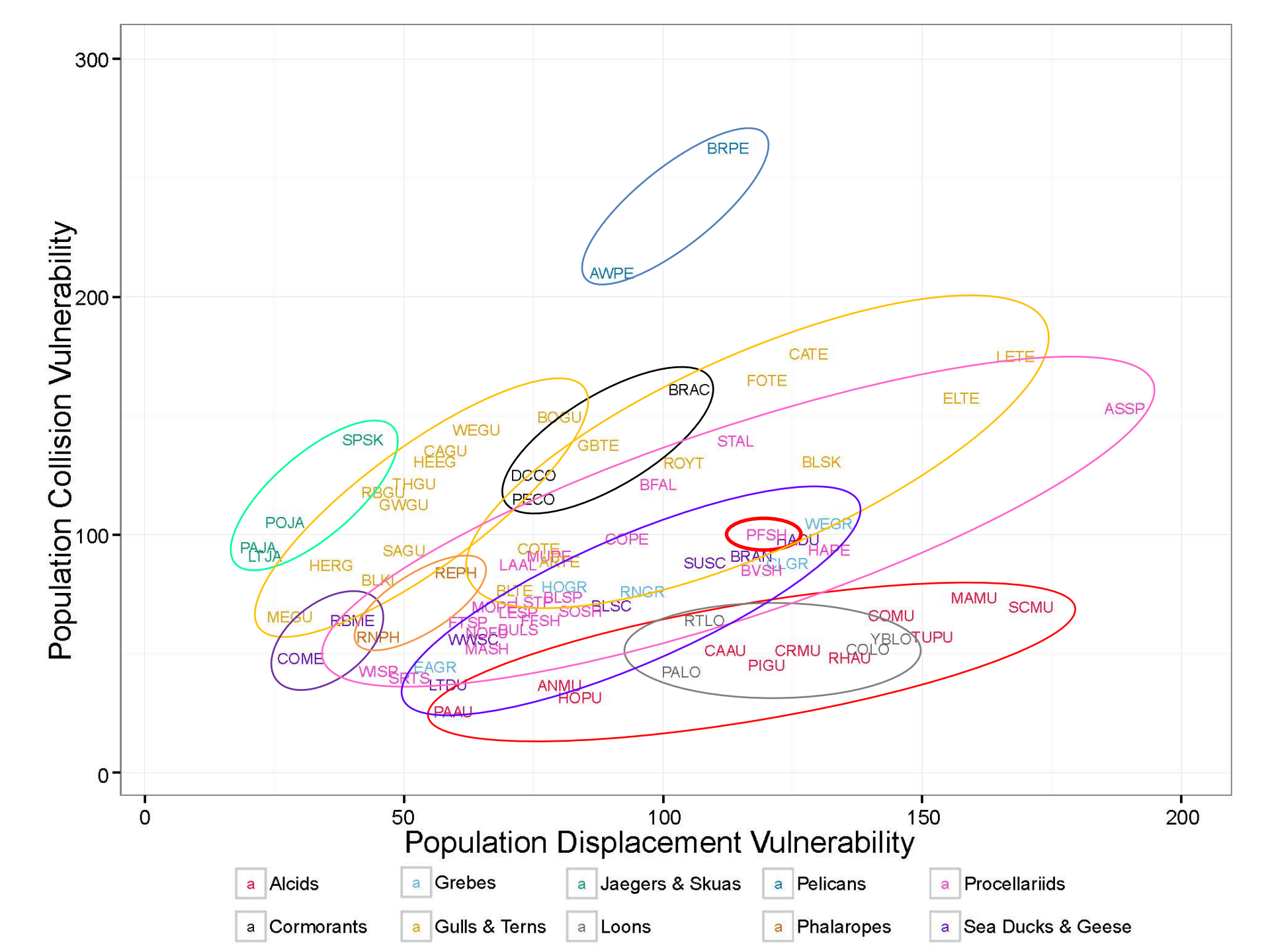
- PDV = 120
- Rank - MEDIUM

Table 3. Values and uncertainties for each metric in the population vulnerability calculation and final population vulnerability scores for all species. POP= global population, CCSpop = population in the California Current, TS = threat status, AS = adult survival, BE = best estimate value, and *u* = uncertainty value (±).

Common Name	POP		AO	CCSpop		TS	BR	AS		Population Vulnerability		
	BE	*u*		BE	*u*	BE		BE	*u*	Lower	Best	Upper
Brant	3.0	1.0	2.0	2.0	1.0	3.0	1.0	3.0	1.0	9.0	13.0	17.0
Common Merganser	2.0	0.4	1.5	1.0	2.0	1.0	1.5	1.0	2.0	5.6	6.0	12.40
Red-breasted Merganser	3.0	0.4	2.0	1.0	1.0	1.0	1.0	2.0	2.0	6.6	8.0	12.40
Harlequin Duck	4.0	0.4	1.5	2.0	2.0	3.0	1.0	4.0	2.0	10.1	14.0	18.40
Surf Scoter	3.0	2.0	2.0	3.0	1.0	1.0	1.0	2.0	2.0	7.0	12.0	18.0
White-winged Scoter	2.0	2.0	1.5	2.0	1.0	1.0	1.0	2.0	2.0	3.5	8.0	13.50
Black Scoter	3.0	1.0	1.5	2.0	1.0	2.0	1.0	2.0	2.0	6.5	10.0	14.50
Long-tailed Duck	1.0	0.4	1.5	1.0	2.0	3.0	1.0	1.0	1.0	6.1	6.50	10.90
Red-throated Loon	4.0	1.0	1.5	2.0	1.0	1.0	1.0	4.0	1.0	8.5	12.0	15.50
Pacific Loon	2.0	1.0	1.5	3.0	1.0	1.0	1.0	4.0	1.0	8.0	11.50	15.0
Common Loon	3.0	0.4	1.5	3.0	1.0	3.0	1.0	5.0	1.0	12.6	15.50	17.40
Yellow-billed Loon	5.0	0.4	2.0	2.0	1.0	2.0	1.0	5.0	1.0	12.6	16.0	18.0
Horned Grebe	3.0	2.0	2.0	1.0	1.0	3.0	1.0	1.0	2.0	7.0	9.0	15.0
Red-necked Grebe	4.0	0.4	1.5	2.0	1.0	2.0	1.0	3.0	2.0	8.1	12.0	15.90
Eared Grebe	1.0	0.4	2.0	2.0	1.0	1.0	1.0	1.0	2.0	4.6	7.0	11.40
Western Grebe	4.0	0.4	2.0	4.0	2.0	3.0	1.5	1.0	2.0	12.1	16.50	21.90
Clark's Grebe	5.0	0.4	2.0	3.0	2.0	3.0	1.5	1.0	2.0	11.1	15.50	22.50
Laysan Albatross	2.0	0.4	2.0	1.0	0.4	3.0	1.0	5.0	0.4	11.2	12.0	13.20
Black-footed Albatross	4.0	0.4	1.5	3.0	2.0	3.0	1.0	5.0	2.0	11.1	16.50	19.90
Short-tailed Albatross	5.0	0.4	2.0	2.0	1.0	5.0	1.0	5.0	2.0	14.6	19.0	21.0
Northern Fulmar	1.0	0.4	2.0	2.0	1.0	1.0	1.0	5.0	0.4	8.2	11.0	13.40
Murphy's Petrel	4.0	2.0	1.0	2.0	2.0	2.0	1.0	5.0	2.0	8.0	13.0	16.0
Mottled Petrel	2.0	0.4	1.5	2.0	1.0	2.0	1.0	5.0	2.0	8.1	12.0	13.90
Hawaiian Petrel	5.0	0.4	1.5	1.0	1.0	5.0	1.0	5.0	2.0	14.1	16.50	18.0
Cook's Petrel	3.0	1.0	1.5	3.0	1.0	3.0	1.0	5.0	2.0	11.0	15.50	18.0
Pink-footed Shearwater	5.0	0.4	1.5	4.0	1.0	4.0	1.0	5.0	2.0	16.1	20.0	21.50
Flesh-footed Shearwater	3.0	0.4	1.5	1.0	2.0	3.0	1.0	5.0	2.0	10.1	12.50	15.90
Buller's Shearwater	2.0	0.4	1.0	2.0	2.0	3.0	1.0	5.0	2.0	8.6	12.0	14.40
Sooty Shearwater	1.0	0.4	2.0	3.0	1.0	2.0	1.0	5.0	2.0	9.6	14.0	16.40
Short-tailed Shearwater	1.0	0.4	1.5	1.0	1.0	1.0	1.0	5.0	2.0	6.1	8.50	10.40
Manx Shearwater	3.0	1.0	2.0	1.0	0.0	1.0	1.0	5.0	0.4	9.6	11.0	12.0
Black-vented Shearwater	4.0	0.4	2.0	2.0	1.0	4.0	1.0	5.0	2.0	12.6	17.0	19.40
Wilson's Storm-Petrel	1.0	0.4	1.5	1.0	2.0	1.0	1.0	4.0	1.0	6.1	7.50	11.90
Fork-tailed Storm-Petrel	1.0	1.0	1.0	1.0	0.4	2.50	1.5	4.0	2.0	6.5	10.50	13.40
Leach'sStorm-Petrel	1.0	0.4	1.0	2.0	1.0	1.0	2.0	4.0	2.0	6.6	12.0	15.40
Ashy Storm-Petrel	5.0	0.4	2.0	5.0	1.0	4.0	2.0	4.0	2.0	20.6	27.0	29.0
Black Storm-Petrel	3.0	1.0	1.5	1.0	0.4	2.50	1.5	4.0	2.0	9.0	13.0	16.10
Least Storm-Petrel	3.0	2.0	1.5	1.0	2.0	2.0	1.5	4.0	2.0	7.5	12.50	19.0
Brandt's Cormorant	4.0	0.4	2.0	4.0	0.4	3.0	2.0	3.0	0.4	19.0	21.0	23.0
Double-crested Cormorant	2.0	0.4	2.0	2.0	0.4	1.0	2.0	4.0	1.0	11.8	15.0	18.20
Pelagic Cormorant	4.0	0.4	2.0	2.0	0.4	1.0	2.0	3.0	2.0	9.8	15.0	20.20
American White Pelican	4.0	0.4	2.0	3.0	2.0	5.0	1.0	3.0	2.0	11.6	18.0	24.40
Brown Pelican	4.0	1.0	2.0	3.0	1.0	5.0	1.5	5.0	1.0	18.0	22.50	25.50
Red-necked Phalarope	1.0	0.4	1.5	4.0	1.0	1.0	1.0	1.0	2.0	7.1	9.0	12.90

	PCV				PDV			
Common Name	-	BE	+	rank	-	BE	+	rank
Brant	54	91	196	MEDIUM	54	117	170	HIGH
Common Merganser	28	48	149	LOW	15	30	78	LOW
Red-breasted Merganser	33	64	138	LOW	17	40	81	LOW
Harlequin Duck	51	98	184	MEDIUM	77	126	173	HIGH
Surf Scoter	30	88	216	MEDIUM	42	108	198	HIGH
White-winged Scoter	14	56	162	LOW	19	64	128	MEDIUM
Black Scoter	26	70	160	LOW	39	90	160	HIGH
Long-tailed Duck	24	37	98	LOW	46	59	102	LOW
Red-throated Loon	26	64	153	LOW	70	108	146	MEDIUM
Pacific Loon	24	42	141	LOW	53	104	165	HIGH
Common Loon	38	52	164	LOW	103	140	164	HIGH
Yellow-billed Loon	38	53	169	LOW	83	144	198	HIGH
Horned Grebe	35	78	195	MEDIUM	46	81	141	MEDIUM
Red-necked Grebe	24	76	207	MEDIUM	46	96	132	MEDIUM
Eared Grebe	14	44	148	LOW	21	56	108	MEDIUM
Western Grebe	36	105	285	HIGH	54	132	208	HIGH
Clark's Grebe	33	88	293	MEDIUM	50	124	214	HIGH
Laysan Albatross	45	88	172	MEDIUM	39	72	86	LOW
Black-footed Albatross	44	121	259	HIGH	39	99	129	MEDIUM
Short-tailed Albatross	49	139	273	HIGH	51	114	137	MEDIUM
Northern Fulmar	36	59	113	LOW	40	66	82	LOW
Murphy's Petrel	40	91	160	MEDIUM	36	78	104	LOW
Mottled Petrel	30	68	153	LOW	28	72	90	LOW
Hawaiian Petrel	52	94	198	MEDIUM	63	132	171	HIGH
Cook's Petrel	48	98	198	HIGH	39	93	117	MEDIUM
Pink-footed Shearwater	48	100	237	HIGH	56	120	140	MEDIUM
Flesh-footed Shearwater	34	67	175	LOW	35	75	103	LOW
Buller's Shearwater	26	60	158	LOW	30	72	94	LOW
Sooty Shearwater	38	70	138	MEDIUM	47	84	100	LOW
Short-tailed Shearwater	18	43	114	LOW	21	51	68	LOW
Manx Shearwater	38	55	120	LOW	47	66	73	LOW
Black-vented Shearwater	38	85	213	MEDIUM	50	119	155	MEDIUM
Wilson's Storm-Petrel	28	43	119	LOW	27	45	77	LOW
Fork-tailed Storm-Petrel	24	60	147	LOW	23	63	87	LOW
Leach'sStorm-Petrel	31	68	129	LOW	32	72	94	LOW
Ashy Storm-Petrel	76	153	319	HIGH	82	189	232	HIGH
Black Storm-Petrel	33	74	177	MEDIUM	32	78	105	LOW
Least Storm-Petrel	35	71	209	MEDIUM	26	75	124	MEDIUM
Brandt's Cormorant	76	161	322	HIGH	53	105	166	HIGH
Double-crested Cormorant	50	125	253	HIGH	33	75	131	MEDIUM
Pelagic Cormorant	39	115	283	HIGH	27	75	145	MEDIUM
American White Pelican	81	210	366	HIGH	35	90	220	HIGH
Brown Pelican	132	263	357	HIGH	54	113	230	HIGH
Red-necked Phalarope	21	57	168	LOW	18	45	97	LOW
Red Phalarope	29	84	213	MEDIUM	24	60	123	MEDIUM
South Polar Skua	62	140	255	HIGH	23	42	102	LOW
Pomarine Jaeger	32	105	210	HIGH	7	27	73	LOW

DRAFT


Population Collision Vulnerability
300
200
100
0
Population Displacement Vulnerability
0
50
100
150
200
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FOTE
ELTE
ASSP
BRAC
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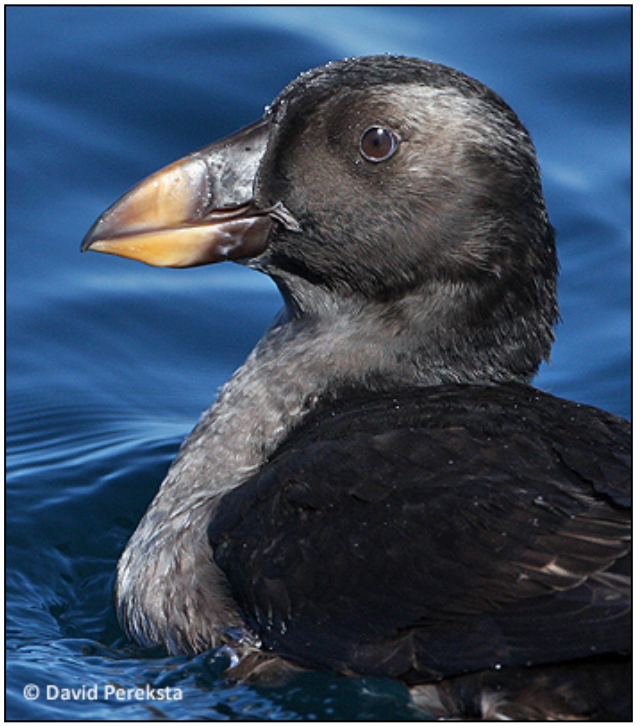
PALO
WISB
EAGR
SRTS
LTDU
ANMU
HOPU
PAAU
a Alcids
a Grebes
a Jaegers & Skuas
a Pelicans
a Procellariids
a Cormorants
a Gulls & Terns
a Loons
a Phalaropes
a Sea Ducks & Geese

Conclusions

Population Collision Vulnerability

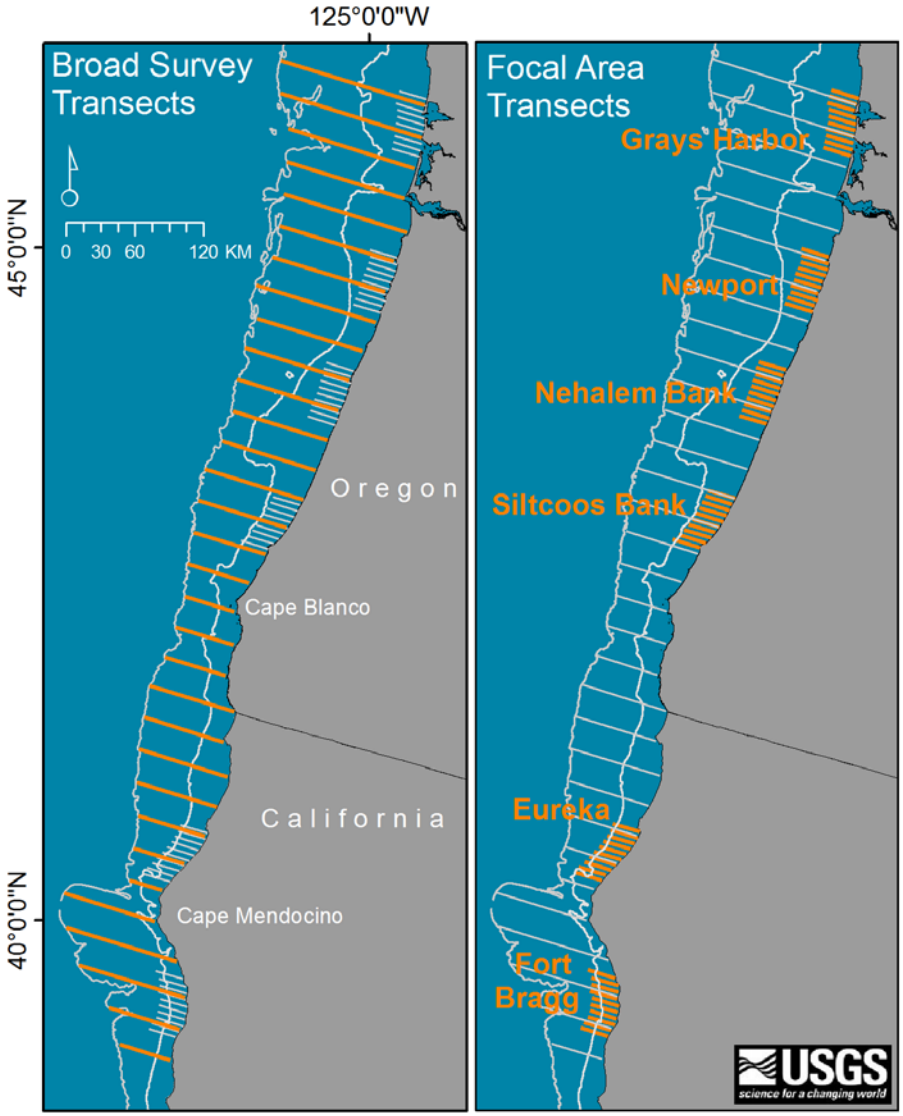
- Pelicans, cormorants, terns most vulnerable
  - High population vulnerability
  - Lower avoidance rates
  - More time spent flying at turbine blade height

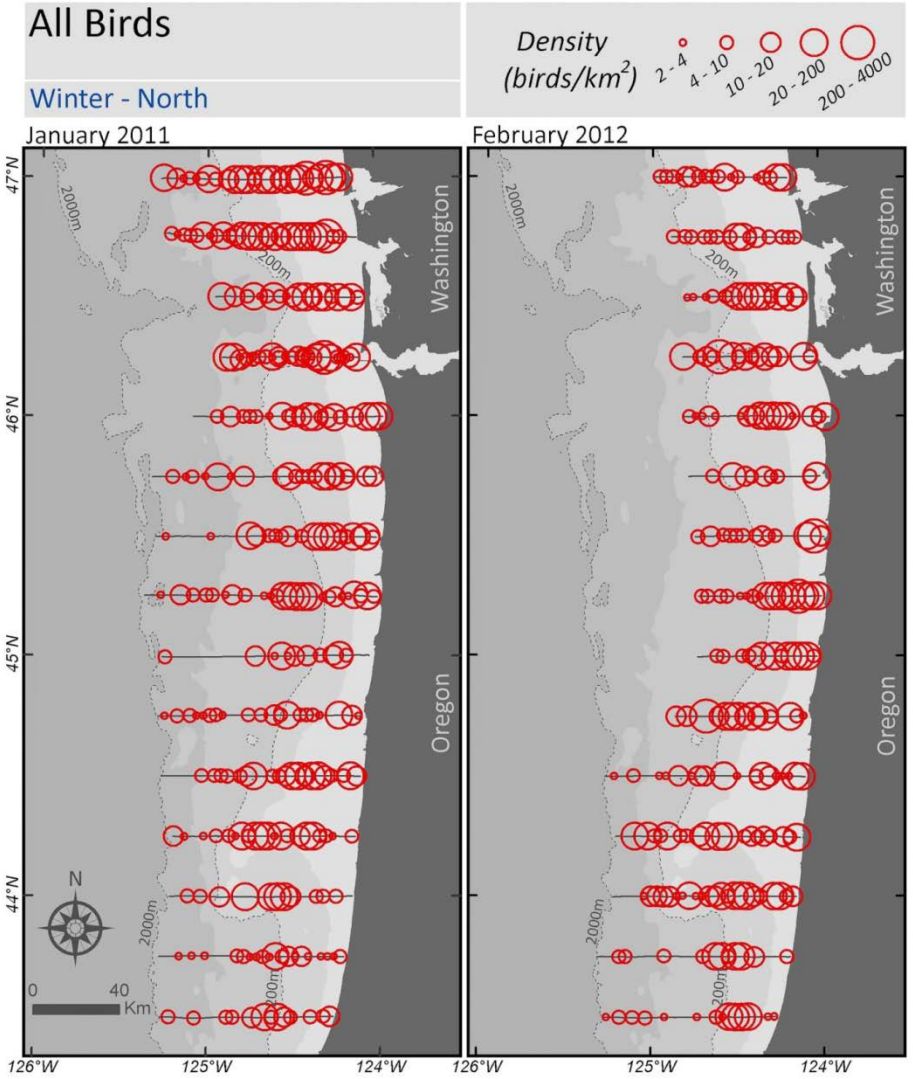


Population Displacement Vulnerability

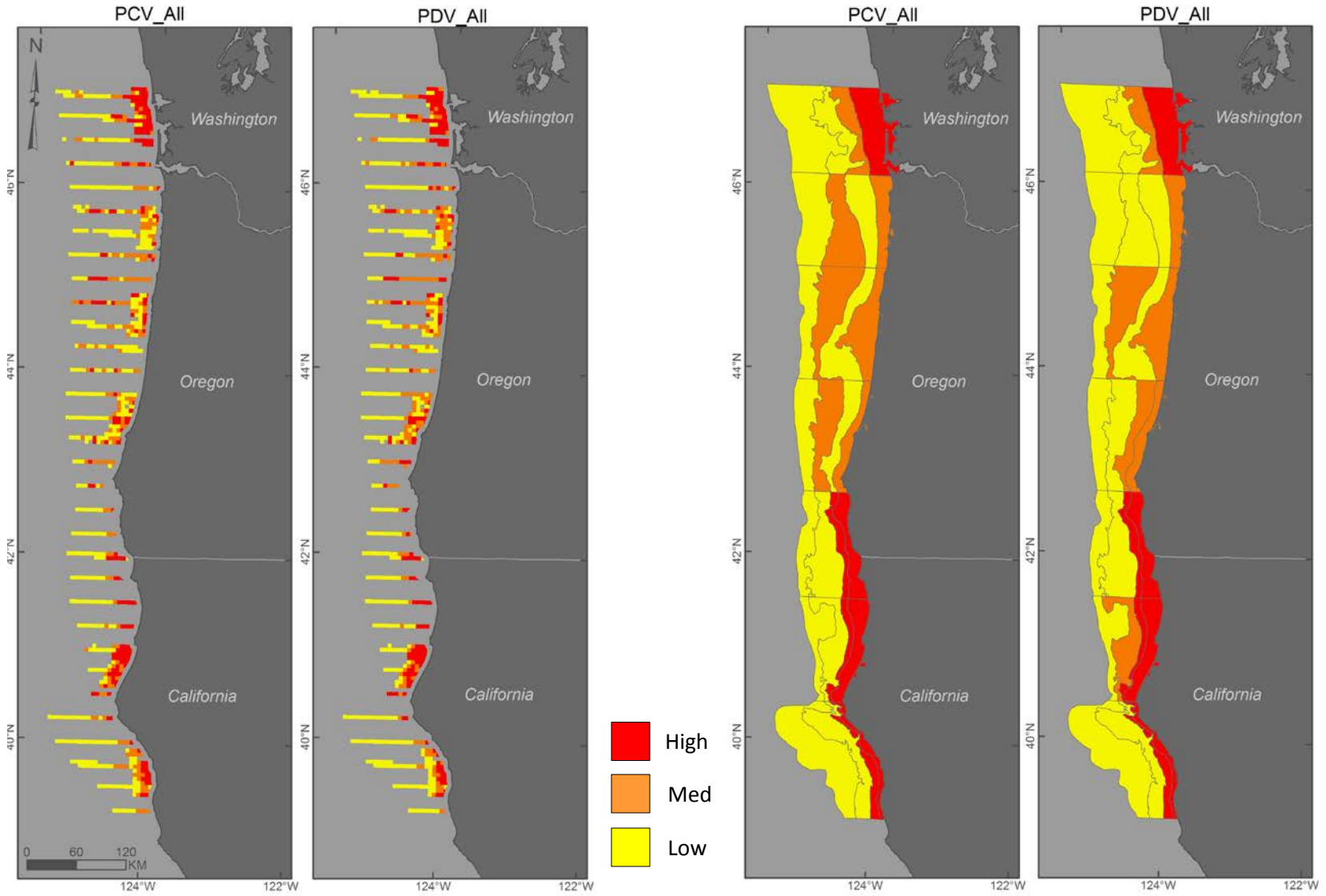
- Alcids, terns, loons most vulnerable
  - High population vulnerability
  - High macro-avoidance
  - Low habitat flexibility

PaCSEA Seabird Surveys





Spatial Vulnerability



Vulnerability Index Application

Scale Possible Adverse Effects of Renewable Energy Projects on Seabirds

- Atlantic and Pacific
  - Expand to Hawaii when data sufficient
- Vulnerabilities can be mapped by density and species composition at sea
- Use results to inform siting and operation of facilities
- Spatial and temporal analysis for entire CCS
- Apply to currently proposed projects off Coos Bay, OR and Morro Bay, CA
- Can be refined over time as new information available

BOEM Contact

David M. Pereksta

Avian Biologist

Bureau of Ocean Energy Management

Pacific OCS Region

805-384-6389

david.pereksta@boem.gov

http://www.boem.gov/Pacific-Region