Cumulative Adverse Effects of Offshore Wind Energy Development on Wildlife

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Key Takeaways

- **Understand the risk**: Cumulative effects is complex, uncertain, and ambiguous

- **Frame the risk**:  
  - First, we must be clear and consistent about framing adverse and cumulative effects  
  - Second, we must set consistent boundaries for cumulative effects assessments

- **Assess the risk**: Cumulative *exposure* can be a proxy for cumulative effects

- **Evaluate & Manage the risk**:  
  - ID species at risk  
  - Reduce cumulative effects by avoiding (siting has limitations), minimizing, and compensating
“Cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR §1508.7)

Cumulative adverse effects (CAE) is a process through which adverse effects accumulate

Effect on individuals accumulate to cause population declines

CAE assessments are inconsistent partly because of a lack of clear framing

Goodale and Milman 2016
What are Adverse Effects?

- **Hazards**: physical changes to the environment
- **Vulnerability**: documented sensitivity to hazards
- **Exposure**: present in a development area
- **Seabirds adverse effects**:
  - Direct: Collision
  - Indirect: Displacement

Crichton 1999
Assess: Cumulative Exposure

- CAE assessments must
  - **Assess exposure**
  - Estimate population effects
- **CE model:**
  - ID where development is feasible
  - Determine number of wind farms
  - Assess if siting can reduce cumulative exposure
  - Relate exposure and vulnerability to ID species at risk
Wind Farm Suitability Layer

- Wind farm input
  - 6 MW Turbines; 8 rotor diameters apart; 300 MW capacity

- Four scenarios, 36 species of birds
  - Shallow water
  - Close to shore
  - High wind
  - Avoid bird use areas
Evaluate CAE: Tiers of Likelihood

**Tier 1**
Seaduck and loon
- 30% population exposed
- Exposed regardless of siting
- Vulnerable to displacement

**Tier 2**
Gull and tern
- 10% population exposed
- Exposed close to shore & shallow
- Vulnerable to collision

**Tier 3**
Auk
- 10% population exposed
- Exposed high wind & deep
- Vulnerable to displacement

**Tier 4**
Petrel and phalarope
- 6% population exposed
- Exposed high wind & deep
- Little vulnerability
Manage: CAE

- **Avoid hotspots**: Exclude development in upwelling areas, shoals, and embayment mouths to avoid exposure
- **Disperse development**: Diffuse exposure across all guilds
- **Separate wind farms**: Provide movement corridors and spread collision mortality over sub-populations
- **Minimize and compensate**: Reduce effects at each wind farm, decrease mortality from other stressors, increase reproductive success

[Link to Northeast Ocean Data Explorer](https://www.northeastoceandata.org/data-explorer/?birds)
Thank you!

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