

Framework for defining the scope of cumulative adverse effects assessments for offshore wind

Wing Goodale

Senior Science Director, Biodiversity Research Institute



Definition Problems

- 2007 Collaborative Offshore Wind Research into the Environment (COWRIE) workshop on cumulative impact to birds (Norman et al. 2007)
 - Primary conclusion = could not agree upon a definition of cumulative impacts
 - Let's try and avoid that!



- What is the challenge?
 - It is undefined
 - There are no boundaries
 - It is a concept within which we place our collective concerns
 - We each approach it based upon our professional and personal background
 - I'm a bird person
 - I'm interdisciplinary
 - Impacts, effects, adverse, negative, positive?
 - Cumulative adverse effects

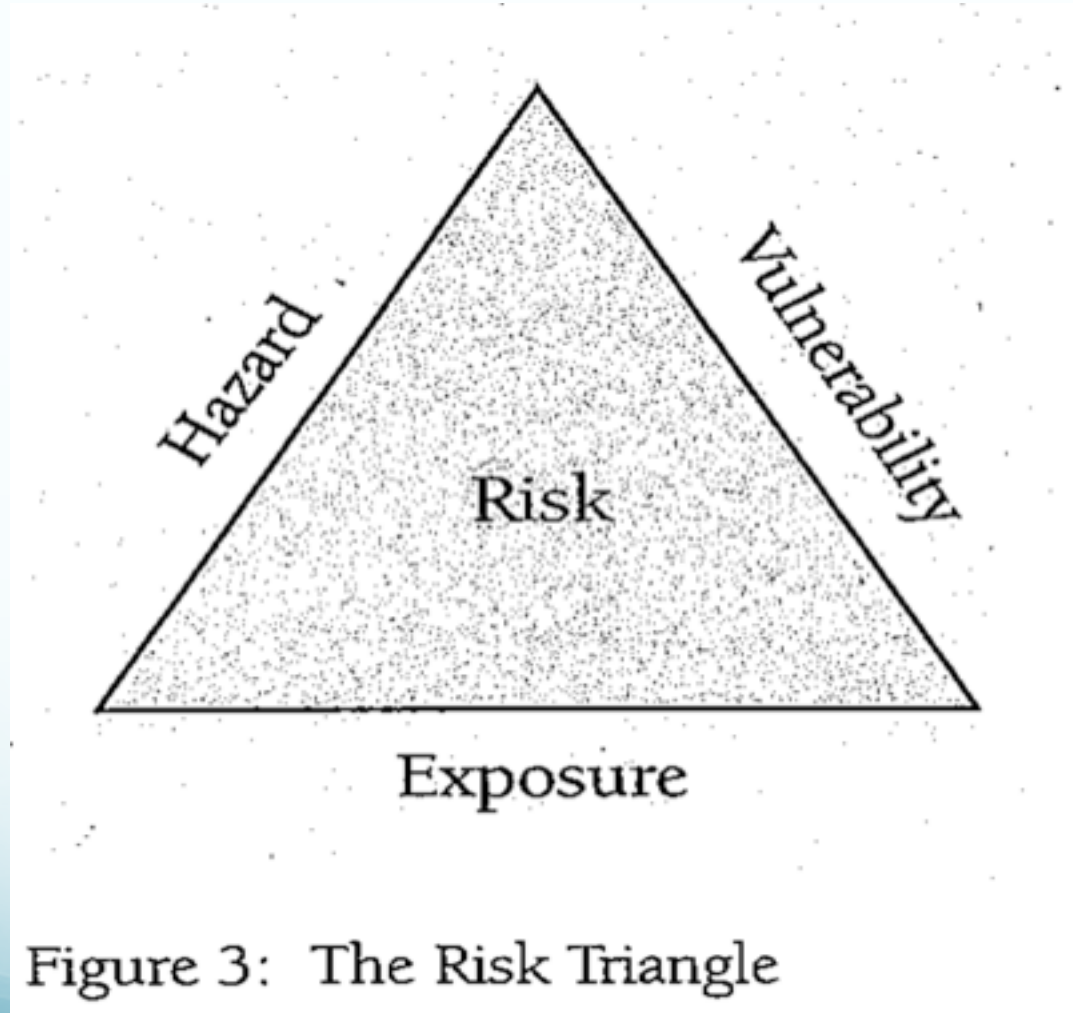
What type of problem?

- **Linear**
 - Cause is well known
 - Negative effects are known, low uncertainty.
- **Complex**
 - Difficulty of identifying and quantifying causal links.
 - Have synergisms, antagonisms, positive and negative feedback loops
 - Time delays between the cause and effect
 - Individual variation, intervening variables, etc.
- **Uncertain**
 - Absence of scientific knowledge that makes it difficult to assess the probability of impacts.
 - Result of incomplete reduction of the complexity in modeling cause-effect chains between hazards and adverse effect on a receptor.
- **Ambiguous**
 - Different legitimate viewpoints
- Cumulative adverse effects are linear, complex, uncertain, and ambiguous

Definitions

- It is the accumulation of all anthropogenic actions over time and space
- “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 is a **process** through which adverse effects accumulate
- Effect on **individuals** accumulate to cause **population** declines
- Assessments are inconsistent partly because of a lack of clear framing

What are Adverse Effects?



- **Hazards:** physical changes to the environment
- **Vulnerability:** documented sensitivity to hazards
- **Exposure:** present in a development area
- **Adverse effects**
 - Direct: mortality and injury; Direct effects are the result of a stimulus response relationship
 - Indirect: a chain of effects pathways that can lead to adverse effects

Hazards

Individual Effects Pathways

Vulnerable Receptors

Exposure

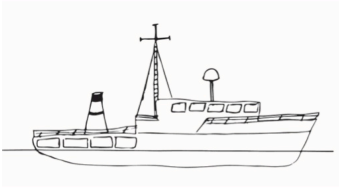
Cumulative Effects Pathways

Goodale and Milman
2016

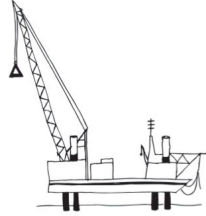
OWED Homotypic

Heterotypic

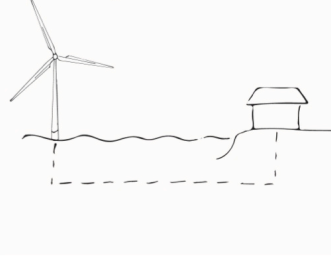
Pre-construction



Construction



Operation



Decommissioning



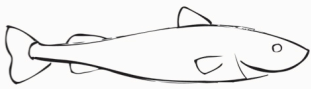
Other anthropogenic stressors



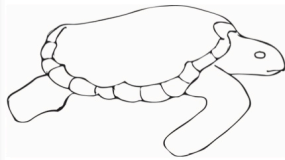
Direct

Indirect

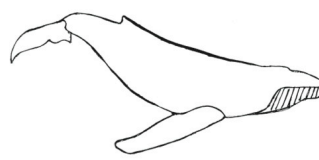
Fish



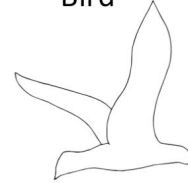
Sea turtle



Marine mammal



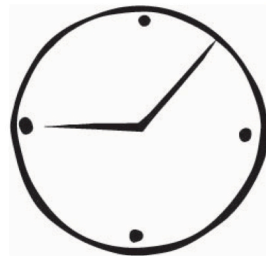
Bird



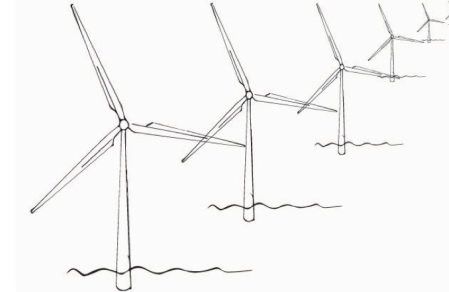
Bat



Time



Space



Additive (CAE = a + b)

Synergistic (CAE > a + b)

Countervailing (CAE < a + b)

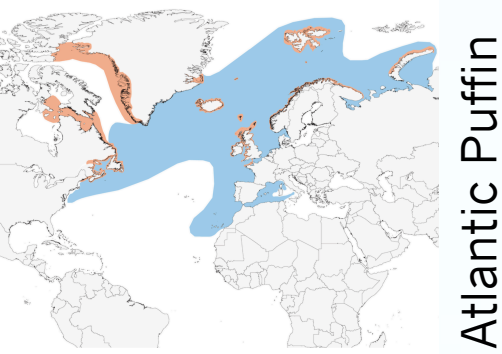
Population Threshold

Population Threshold

Cumulative Adverse Effects

Cumulative
Adverse
Effects

*Moving from a
theoretical
discussion to
an applied
analysis*



Scoping

Hazards & Vulnerability

- Hazards
 - **Homotypic: offshore wind only**
 - Heterotypic: everything else
- Effects pathway
 - Individual: Direct, indirect
 - Cumulative: **Additive**
- Vulnerability
 - Behavior
 - Physiological
 - Habitat specialization

Receptors

- Which species, groups, or communities?
- Which population?
 - Entire species range?
 - Sub-population?
 - Individual breeding sites?
- Measuring population effects
 - Having clear baseline (status before impacts)
 - Stating a threshold (number of trend?)

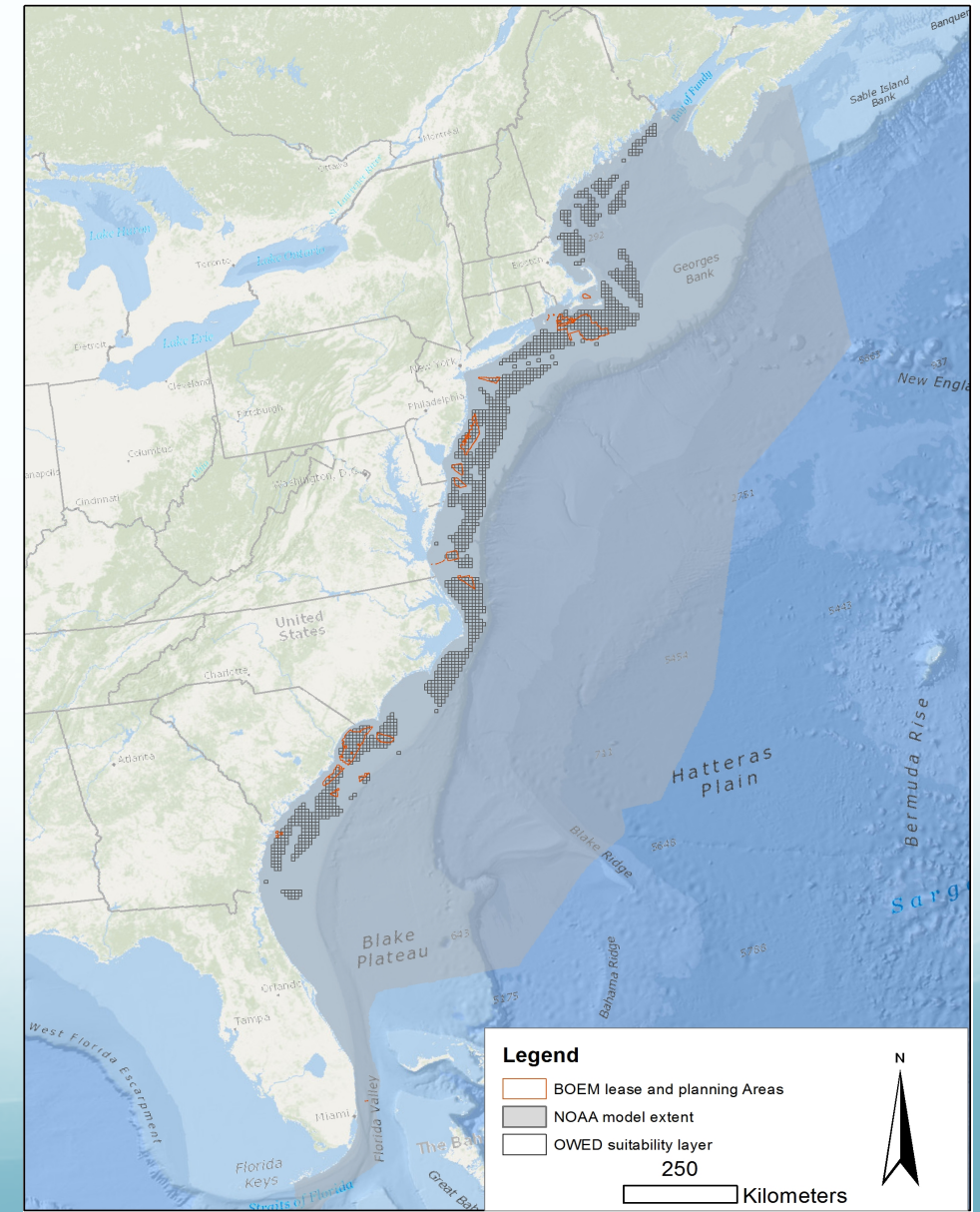
Delineating Exposure

Temporal boundaries

- Duration of hazard; species ecology
- Data constraints (extent of of MDAT models)

Spatial boundaries

- Geography: Atlantic OCS
- Ecological
 - Species range
 - Ecological regions
- Political & Planning Areas
 - BOEM Wind Lease Areas
 - US Federal Waters
- Engineering
 - Basic wind development constraints



Birds example

Adverse Effects

Focal species: high vulnerability, conservation status

Hazard

Vulnerability

Project
Exposure

Cause-effect
relationships

Changing
Turbine Design

Flight Heights

Data

Collision

Changing
Turbine
Spacing

Avoidance
Rates

Changing
Distributions:
Climate Chng

Displacement

Cumulative Effects

Population
Dynamics

Spatial Scope

Temporal
Scope

Linking to
offshore wind

Things to consider in developing a research agenda

- Be aware of the blind researchers and the cumulative elephant
 - Researcher background, research focus, taxonomic focus, and training
- Be very specific with definitions and assumptions
- Define a tight scope for research
 - Try and avoid the “but what about . . .” spiral
- Recognize scopes may vary significantly from species to species
- Define needs to model the future **AND** needs to collect empirical data today
 - Modelers can help define parameters (e.g., PVA); field researchers can collect data
- Identify technological constraints in understanding adverse effects
- Focus on small bites, and not trying to answer the ultimate question



Thank you!

Wing_Goodale@briloon.org
(207) 807-8750

