Mitigation Working Group

(highlighted points are particularly important although there was not enough time to do a complete prioritization):

List of Threats—Note: there may be temporal variation in these threats across the life of the project. Monitor these changes over time.

- Habitat displacement (breeding, foraging, resting, commuting)
  - Foraging habitat loss, e.g. common loon
  - Cable placement might direct impact nest sites
  - Shoreline infrastructure
  - Barrier to commuting flights?
- Direct strikes/mortality
  - Low level chronic versus catastrophic episodic
- Migration disorientation
- Attraction—nuisance attraction, they are coming to something we didn't intend (lighting, artificial reefs)
  - What is the lighting? Cape Wind as one example: 1 red light on nacelle on perimeter of wind farm, brighter on one side than other. Lights in center at service platform. Intermittent. Yellow lights on base of each turbine—but this is not clear.
  - Perching issues on maintenance platforms
  - Reef effects—food source
  - Unknown (e.g. bats)
- Threat of oil spills from gear boxes
- Shipping related issues
- Helicopter/vessel disturbance during maintenance
- Cumulative effects
- Effects of reduced visibility, inclement weather
- Energetic costs of displacement or loss of foraging habitat or disturbance

Types of Mitigation: Anything that can reduce the impact of a project, any way to stop threats, broad definition—avoidance, mitigation, compensation

Avoidance

- Site selection
  - Landscape level, such as prohibiting leases of other wind farms nearby, limit the # of wind farms in an area
  - Use existing infrastructure, or use "disturbed" areas, add-on to an existing "area"
  - Early in the process, develop a landscape-level and site-specific risk assessment matrix to identify areas good for development with low bird impacts, and vice versa
- Turbine array design and layout

    - Vertical axis vs. horizontal blade, some discussion for use in land-based projects, much smaller rotor sweep zone in vertical axis turbines
    - Are certain configurations possible
    - Size of turbine and associated footprint, bigger and fewer vs smaller and more numerous
- Construction in phases
- Measures to force a detour
- Using noise as a deterrent—this has been used in Canada for oil spills, is being developed for bats
- Consider alternative technologies to wind, such as current

Mitigation – must vary with/ adapt to species. Must be coordinated with mitigation methods for other sensitive groups (e.g. marine mammals)

- Colors of blades and turbines
- Lighting—color, direction, and frequency of flashing, down vs up-shield, placement
- Anti-perching—not easy to do
    - Deter predator attraction
    - Deter conspecific attraction
    - Reducing perching through turbine design
- Construction in phases, and during seasons of less sensitivity
- Shutdown during periods of migration or inclement weather—partial or complete (other method to address collision with inclement weather)
    - If real-time detection becomes possible, connect to the wind farm lease?
- Extension of lease contingent upon good performance, project kick-out clause
- Contain leakage from gear boxes, reduce potential for spills
- Periodic inspections, reporting
- Avoid flocks with service vessels

Compensation (local, regional, international) *Restoration*

- Habitat conservation program, habitat enhancement, habitat restoration and/or creation
    - Such as marine sanctuaries, state or federal
- Species or group specific, reducing mortality or increasing productivity
    - Nuisance/invasive predator control
    - Fishing vessel buyout—not everyone agrees
    - Preserving and/or increasing nesting habitat/ increasing productivity
    - Reducing habitat disturbance in sensitive areas
    - Hunting , note: this would involve another level of compensation to the hunting community, such as funds to duck stamp program, hunting preserves…
- Bonds for pre- and post-construction monitoring and/or life of project; Fund vs. bond, cash money

    - Are there new or creative ways of directing funds towards habitat enhancement projects
- State revenue sharing
- While not preferred--Out-of-kind, non-bird or bat
    - Carbon sequestration
    - Non-marine habitat conservation

Species Groups/Threat—not time to do this today

What types of research and monitoring is needed to test mitigation

- Detailed analyses such as population viability analyses for species at risk
- Rigor in quantification and accuracy
- Quantify and qualify risks to inform decision-makers, to understand how risks need to be monitored
- Metric system for risk assessment, something that links policy-makers and biologists

Overarching Ideas:

- Relative potential for impacts is going to drive level of monitoring, mitigation, compensation.

Mitigation "add-ons" based on discussion with all participants

- Energy production and turbulence-balance optimum for energy production with optimum for reducing environmental effects
- Different geometric shapes that might reduce impacts to the environment
- Set rigor for what level of impact want to quantify and what level of accuracy will be accepted (mitigation and monitoring plan)
- Shutdowns (Altamount Pass study- 60% less collisions with shut downs in inclement weather but 40% still hitting)
- Lots of discussion on effectiveness of shut downs- can profit can be made with operating at high speeds (yes, turbine designs are being changed to operate at high speeds)
- Vessels issues for sea ducks and loons; vessels should avoid concentrations of these birds; reducing construction during this time would also benefit these species
- Mitigation strategy will vary depending on species you are concerned about; be adaptable
- Mitigation measures for birds should be done in coordination with mitigation for other species so as to not rule out or overlap; balance with other impacts
- Interdisciplinary mitigation and monitoring to address multiple species and issues
- Can you flip turbine blades during periods of low visibility and inclement weather? Are there other ways to reduce surface area during these periods with changes to rotor design area?; explore new design technologies to see what is possible or being developed

- Much more research needs to be done to see what is effective in reducing mortality or increasing avoidance