



Cut-In Speeds



The Feasibility and Implications of Modifying Cut-in Wind Speed for Bat Mortality Mitigation

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Overview

- Overview of Natural Resource Solutions Inc.
- Background Research
- Bat Flight Characteristics & Wind Speeds
- Challenges to Operators
- Matching Mitigation to Species & Site Specific Conditions
- Offshore Wind Projects
- Recommendations





Definitions

Cut-in Speed - The speed when the turbine starts to produce power.

Start-up Speed - This is the speed at which the rotor and blade assembly begins to rotate.

Curtailement – Modifications to the total power or rate of power delivered to system

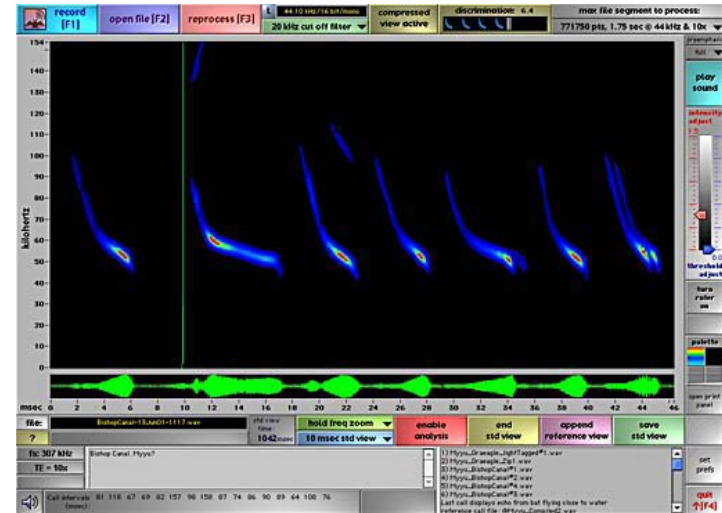


The combination of the amount of time that the wind speed is at different levels (wind speed distribution) and the characteristics of the proposed turbine (power curve) determine energy production



Introduction

- NRSI started bat monitoring for wind power projects in 2003
- Acoustic and radar monitoring
- Involved in over 4000MW of wind power projects in Ontario, Manitoba, Saskatchewan, Alberta, and New Brunswick
- Projects range from individual turbines to some of the largest wind projects in Canada





Overview of Research

Research into the effectiveness of modifying start-up and cut-in speeds found substantive reductions in bat mortality:

Baerwald, E., J. Edworthy, M. Holder, and R.M.R. Barclay. 2009. A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities. *Journal of Wildlife Management* 73(7):1077–1081

Arnett, E. B., M. M. P. Huso, J. P. Hayes, and M. Schirmacher. 2010. Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities. A Final Report Submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Widespread citation of the results of these two studies, including site-specific results in terms of cost implications.



Overview

“In recognition of the indisputable threat to bats posed by wind turbines, and amid emerging documentation of the effectiveness of increased cut-in speed during fall migration in reducing bat fatalities, we recommend a standard operational protocol requiring that cut-in speed of all commercial wind-power turbines in Virginia be set no lower than 5.0 m/s, from sunset to sunrise, from July 16 through October 31, pending further review. At the discretion of DGIF and in cooperation with commercial wind-energy facility operator(s), an experimental protocol allowing some turbines to operate at lower cut-in speeds may be implemented to test the effectiveness of this standard.”

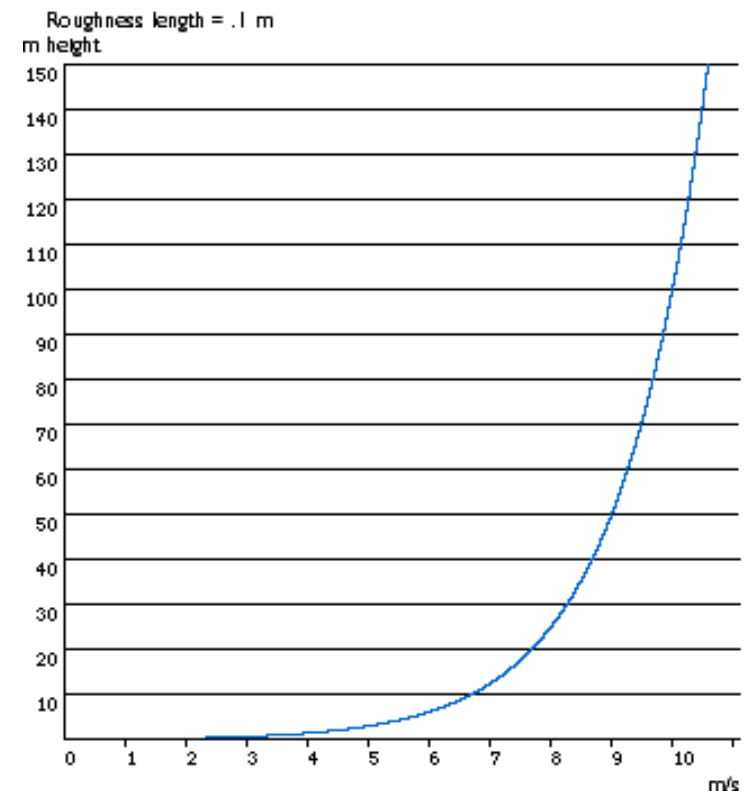
Guidelines for Wildlife (birds and bats) Impact Assessment, Monitoring, and Mitigation at Proposed Wind-Energy Facilities in Virginia: Mountain Regions.

Virginia Department of Game and Inland Fisheries Bureau of Wildlife Resources (June 2009)



Wind Speeds & Flight Heights

- The challenges of understanding wind speeds at bat flight heights
- Roughness of the ground surface has large impact on the differences in wind speed at different heights
- In terrain with a high roughness difference in wind speed between ground, tree canopy, vs hub height
- Can get a difference of several m/s in wind speed between lower vs upper swept area

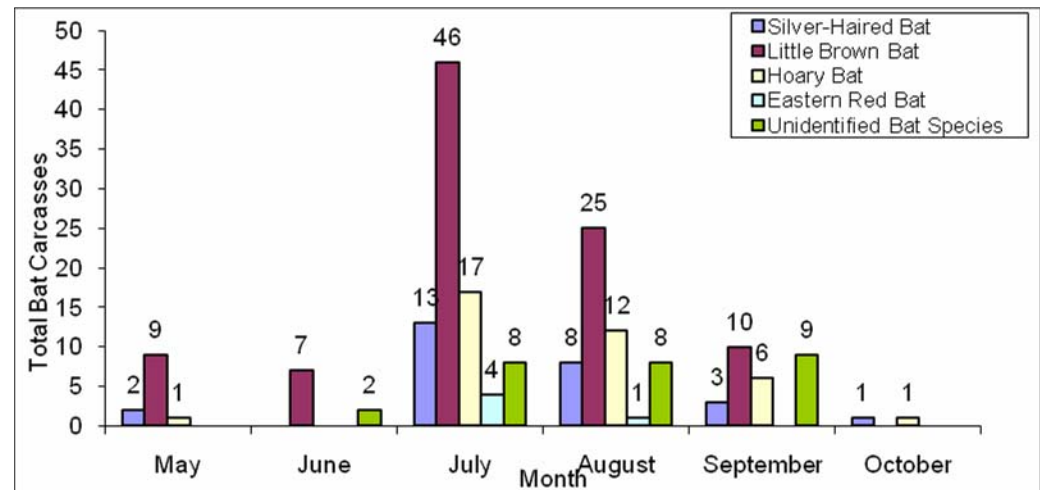


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Bat Mortality

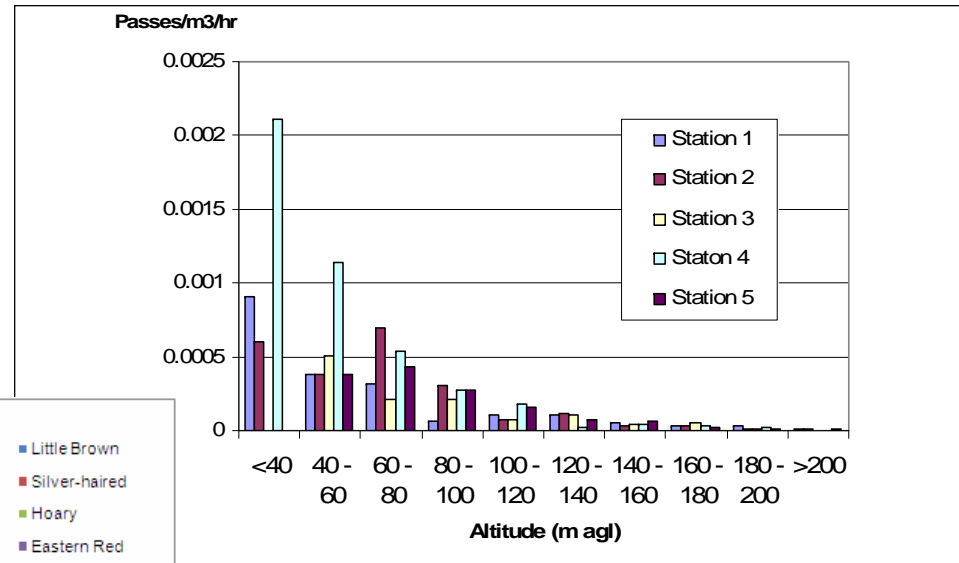
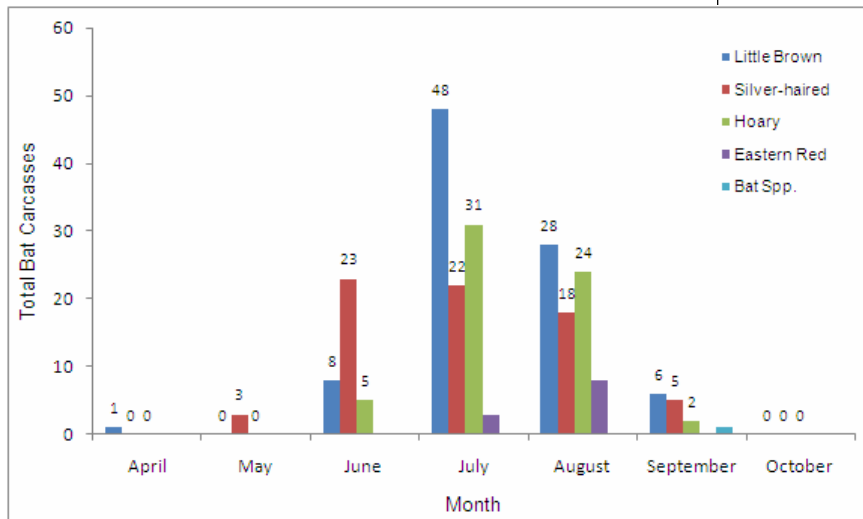
- Historically the understanding was that the vast majority of bat mortalities were of migratory bat species
- Beginning to see mortality data consisting of a wider range of bat species, including resident bats
- Flight characteristics of resident bats vary through season and differ from flight characteristics of migrating species
- Do the findings of background studies that focused on migrating species apply?





Variations in Bat Activity

Seasonal, daily and hourly variations in bat activity.





Optimum Approach

- Matching mitigation to specifics of bat activity
- If we accept cut-in speed as mitigation, optimum would be to match the cut-in to the specifics of bat activity patterns both spatially and temporally
- Specifically:
 - When?
 - Where?





Challenges to Operators

- Choosing the right turbine/modifying existing turbines
- Siting in low wind speed areas
- Occurrences of prolonged low wind speed months (summer)
- Portions of a project with challenges not shared by entire facility

“The only problem with a low cut-in speed is that there is really no power in low winds. There is no reason to be excited if a turbine is featured to have a low cut-in speed.”

“This kind of power generating technology is therefore ideal for wind power generation because its initial operation torque (cut-in speed) is lower than the current ... method.”

What is the impact of curtailment due to mitigation on energy production when the period of concern is extensive and turbines cannot be modified to change on a daily basis?



Offshore Wind Projects

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- Little is known about bat activity patterns offshore
- Most current monitoring extends to shore and in some radar monitoring programmes to 1 to 2km offshore
- But data is limited
- Mortality monitoring will be impeded
- Current approach, especially in Ontario, is to take a precautionary approach and apply curtailment mitigation during peak bat activity months





Recommendations

When the trigger for modifying cut-in speed is based on corrected mortality levels, spend the effort to generate the highest confidence in the mortality results (i.e. you want to be sure)

Ensure that the bat monitoring protocols proposed for the project are not only going to satisfy review agencies, but also protect the owner's interests with respect to possible need for mitigation (i.e. is monitoring at proposed turbine locations warranted?)

Optimum would be to match the implementation of cut-in speed modifications to the specifics of bat activity (daily, seasonally, site-specific)

Can a case be built to apply the mitigation to specific problematic turbines?



Recommendations

Consider a system that can be readily modified to match some of the above (i.e. modifying individual turbines, daily, seasonal, daily)?

Consider the cost effectiveness of choosing/modifying the turbines vs implementation of curtailment

Are there other mitigative measures that could be used ? And consider the relative costs and effectiveness

For offshore projects, collect data that can refine our understanding of bat activity patterns and risk

