Wildlife & Wind Energy: Considerations for Monitoring and Managing Impacts

Webinar 4: Bats

Questions and Answers

What are some lessons learned from conducting field studies at proposed or operating wind energy facilities (i.e., examples where you needed to adapt)?

Trevor Peterson: equipment will fail…deploy extra and design your monitoring program with a buffer that accounts for reasonable amounts of data loss.

Matt Becker: This is more related to deploying and testing technologies but can also apply to other wildlife studies: Information that needs to be communicated between the technology vendor and plant is not always conveyed or understood, so having a detailed checklist of questions can help manage expectations and needs. Nothing ever works exactly as expected, so the burden on wind plant personnel is always greater than anticipated. Study designs need to capture realistic maintenance and operations challenges rather than being limited to wildlife results, to understand the cost benefit ratio of the technology.

Sara Weaver: Never underestimate the destructive power of cows. At one site we went through four different ways of staking transects before we found something that the cows couldn't eat or destroy. We would have used the rope method instead, but our plots were too large (100 m radius). They also complicate search efforts at roads and pads because they will hangout in the shade of the turbine. Manure turns easy visibility into difficult because it looks just like a bat. Also, always ask about number of gates at a site when planning how many turbines can be visited per day. In general, plan extra time for maintenance activities every month. Finally, don't rely on cell phones to work. At many sites there is poor cell coverage.

How does the US rate bat mortality compare to Europe or Latin America?

Amanda Hale: I don't think we have good data to be able to answer this question currently. The bat mortality data that are available do not represent a random sample of wind energy facilities from these 3 regions, meaning that it is not possible to know if the data are truly representative of what's happening in the US, Europe, and Latin America. Another important issue that impedes direct comparison is that the survey methods, estimators used, bat community, scavenging rates, etc. all vary within and between these regions. We do know, however, that bats are being killed at wind energy facilities worldwide and that this isn't a problem that is isolated to North America.

What are some pointers to keep detectors/microphones powered, protected and functional?

Trevor Peterson: Newer acoustic detectors use minimal power and are pretty reliable, even when deployed for long periods. That said, it's important to ensure internal clock batteries are fresh, and to include a bit of extra capacity for any solar panel/rechargeable battery systems. Also, it's always a good idea to check detectors regularly and offload data. I'm waiting for acoustic detectors that are capable of "self-checks" (e.g. generate a test signal at a regular interval to ensure consistent microphone sensitivity and proper operation) but am not aware of any that do this yet. Lastly, it's important to review system

status files after an acoustic survey to confirm proper operation of detectors throughout a monitoring period.

Based on your finding, what are your thoughts on using existing data or collecting new data to see whether a predictive relationship between bat activity and bat mortality exist?

Trevor Peterson: I think we know enough to say that pre-construction bat activity is not well suited to predict the magnitude of bat fatality, but that pre-construction bat activity recorded in the rotor-swept zone *does* predict seasonal patterns in fatality and overall trends in species composition. I also think nacelle-height data collection at existing turbines provides excellent data on exposure of bats to turbine operation, which we have found to be closely correlated with fatality. I think a question that is more important than whether bat activity levels correlate with fatality is whether potential impacts to bats can be managed at a proposed site should fatality rates be concerningly high. This is where acoustic data have real potential in simulating cost and benefit of different curtailment programs and designing strategies that are tailored to site-specific patterns in risk.

Have you examined the data based on call duration rather than number of call passes, similar to what is discussed in Kerbiriou et al. 2018?

Trevor Peterson: I haven't reviewed recent papers by Keribiriou et al. in detail but understand they used a metric of call duration to differentiate commuting vs. foraging bats. This gets at the ability to evaluate bat behavior acoustically. There are many aspects of echolocation (like call duration, presence of feeding buzzes, social calls, etc) that tell you a bit more about how bats may be using an area , although I have not attempted to incorporate these into analyses for wind farms. As a side note, I often record relatively long bat call sequences at turbine nacelles and meteorological towers, often including social calls.

Has acoustics data been used in curtailment strategy with success already? Or is it just a proposed application?

Trevor Peterson: We have a paper in review that summarizes use of passive data to quantify fatality risk and have successfully designed and modified curtailment programs using acoustic data at two West Virginia wind farms. Also, a paper by Hayes et al. (2019) summarizes use of Normandeau's "TIMR" system, which uses near-real-time acoustic data as an input for a triggered smart curtailment system. The DOE is currently funding a research program to test use of acoustics to inform several distinct approaches to smart curtailment.

Another application I didn't have time to mention today is the potential use of nacelle-height acoustic data as a long-term monitoring strategy to evaluate the continued effectiveness of curtailment (passive acoustic monitoring is a small fraction of the cost of carcass monitoring). In this context, acoustic bat data coupled with operational data and weather readings are ideally suited to adaptively manage risk to bats because they indicate conditions under which exposure (and therefore risk) occurs.

How do you keep field crews motivated/focused when conducting searches?

Sara Weaver: Post-construction monitoring is a tough job. Searchers stare at the ground all day looking for dead animals, which is pretty depressing. One way to keep them motivated is to do challenges with rewards for high Searcher Efficiency. Having crew leaders and project managers that treat you as a valued and needed employee helps a lot too. It's also a good idea to have crew get-togethers to create

camaraderie. If they are searching in a hot climate, having ice pops always available is a nice treat that can go a long way.

How do you reduce bias when searching turbines?

Sara Weaver: Randomize everything that you can. For example, the order turbines are searched in a day and which direction you start a search for each turbine should change each week. Also, switch out who does the searching of each turbine, so the same person isn't always searching the same turbines.

Have you used surrogates for bias trials? How do they compare with using the actual species?

Sara Weaver: I have only used bats because research indicates surrogates bias carcass persistence and searcher efficiency. My advice is to get the proper state permits so that you can handle carcasses and use the bat carcasses discovered at the site for trials. If a site has low bat fatalities, see if you can use bats from another site in the same state, or even if not in the same state at least with the same species. Never use birds in place of bats. Even mice introduce a bias, so I recommend doing whatever you can to not use surrogates.

Who typically carries out mortality studies? Are thos done under a regulatory requirement? What is the typical cost for the survey (range)?

Sara Weaver: Most often consultants like myself are hired to conduct mortality studies. Sometimes universities do this as well, but it is usually a third-party and not the company doing the work. If there is concern regarding take of a federally listed species, then there can be a federal regulatory requirement under an Incidental Take Permit (ITP). Otherwise, it is at the state-level, and this varies by state. Cost varies widely and is highly site specific. There are too many variables that can influence a budget, such as number of turbines, plots vs. roads and pads, duration, frequency, etc., so I hesitate to give a cost, even a range. They are typically in the hundreds of thousands though.

Is there a significant time commitment to collecting tissue samples from carcasses?

Amanda Hale: The time required to collect tissue samples is minimal, on the order of a couple of minutes per carcass to collect both a wing tissue sample as well as hair. This could be done in the field at the time of carcass discovery/collection or later if the carcass is going to be frozen for use at a later date.

What level of granularity is necessary for carcass data used in genetic analyses?

Amanda Hale: The level of granularity depends on the research question that is being addressed. If anonymity of the specific locality data is desired as a condition of donating samples, then it would be straight-forward to obscure the location. For example, the location of the carcass collection could be at the county level (if there are multiple wind farms and/or owner operators in that county or even at a higher level such as the USFWS Level III Ecoregions or state level.

What are the cost estimates for genetic analyses?

Amanda Hale: We recently estimated our in-house cost per sample (including DNA extraction, sequencing the barcode region, and determining sex) is USD $ 7.35. Sex determination alone, from DNA extraction to PCR, would be USD $ 1.00. The cost to develop multi-locus genotypes using existing microsatellite markers or next-generation sequencing is going to be more expensive and will vary with the number of loci and samples. These types of analyses can be done by a commercial research lab or alternatively at academic or governmental research labs with access to the necessary equipment, software (for analyzing the DNA barcoding results), and expertise. Numerous individuals and institutions already have the skills

and expertise in place to generate these types of data. The cost of obtaining next-generation sequencing data is decreasing as advances are being made in technology, lab techniques, and analytical methods.

Can you speak more about the idea of coating the turbine tower and material/texture used?

Amanda Hale: The development of a texture coating is based on the water misperception hypothesis and the acoustic mirror effect, both of which relate to how echolocating bats identify resources in the wild. Previous research has shown that bats will repeatedly try to drink from smooth surfaces because they misperceive them to be water. Similarly, previous research has shown that detection of prey by bats can be facilitated by smooth backgrounds, such as water surfaces and leaves. We therefore designed a series of experiments to characterize how wild-caught bats interact with smooth and texture-treated surfaces in a controlled, flight facility environment. We used the results of these experiments to develop a texture coating that was applied to two operational wind turbine towers. We then surveyed bat activity at smooth and texture-treated wind turbine towers over one season. The results from the flight facility experiments were promising (i.e., we observed a significant decrease in bat activity at smooth compared to texture-treated surfaces); however, due to coating installation and application challenges prior to our field test, we were unable to collect sufficient information to understand how these coatings affect bat activity at operational wind turbine towers. We recommend that further observations should be made at these towers before concluding whether a texture coating could be an effective mitigation strategy.

What advise do you have for those new to wind & wildlife on conducting safe and efficient monitoring studies?

Matt Becker: See answer #1 at the top regarding communication/detailed checklist, nothing working exactly as expected, and realistic study design. Really think hard about the question that you're trying to answer.

Before conducting studies – especially anything testing a technology or going beyond a standard PCM study – consider and discuss what can be divided into four categories:

- Installation (e.g., attachment to turbines, power/integration requirements, permitting needs, equipment needs, support from operations team)
- Operations (e.g., how will data will managed and moved, what happens when equipment is not functioning, what level of maintenance will be required and who will conduct it)
- Study design (e.g., do turbine operations need to be altered, is any ground clearing needed, is other equipment needed, how many people will be onsite and when), and
- Decommissioning (e.g., when will it come down, equipment needed for decommissioning).

Other lessons learned from studies: Don't assume even the simplest work, like changing a memory card or battery, can be done alone. For health and safety reason, anyone working onsite typically has to be in pairs. Also, even today, don't assume you'll have cell phone coverage!

Can you speak to the various levels of communication that are necessary within a company (i.e., who do you communication with to keep everyone on the same page)?

Matt Becker: This will often be case by case, but is definitely challenging. Most operators are made up of multiple groups that may have different objectives. The checklist mentioned above helps. So does a communication protocol, like a "phone tree," helps define who gets the first call, who they call, etc. depending on what type of information needs to be communicated. Is it a logistic thing, like we are

needing to seed carcasses? Call the plant manager. We need to contact the state agency? Call the permitting manager. Etc. Also given that you may be dealing with things that have legal liabilities (MBTA, ESA, state laws) associated with them, which carry both civil and criminal penalties, phone communication is often the best, or if written communication is necessary, sent directly to the company's general counsel.