# Final Evaluation Report

| Your Details | |
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| **Full Name** | Maha Salameh |
| **Project Title** | Understanding the environmental and local factors behind bat mortalities in a wind farm in Türkiye |
| **Application ID** | 40160-1 |
| **Date of this Report** | 30/01/2025 |

**1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.**

| Objective | Not achieved | Partially achieved | Fully achieved | Comments |
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| Address the gaps in our understanding of bat species populations in a wind farm in Türkiye | | | X | There is a significant presence of bats in the project area in the Kıyıköy wind farm. The Highest bat activity overall was in September and the lowest bat activity generally occurred in July.<br>A minimum of 15 species has been recorded. Among them, Savi's Pipistrelle (Hypsugo savii), Nathusius' Pipistrelle (P. nathusii), Noctule Bat (Nyctalus noctula) and Leisler's Bat (N. leisleri) are considered to have high collision risk. |
| Expand our knowledge of bat attraction to wind turbines | | X | | As proposed, an initial plan was to record bat sounds near 1) in a control area which was selected to be near the turbines, with similar weather conditions, but far enough to avoid the turbine lights and noise, ensuring that the noise in the control area was inaudible to the human ear, 2) near a non-operating turbine due to weather conditions , 3) near an operating turbine, also 4) near a turbine that was non-operating due to malfunction. However, during all of our visits, because turbine malfunctions were repaired on the same day, and the turbines were operational before the end of any working day, this recording |

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| | | | | condition was replaced with a comparison between an operating turbine with the most carcasses and an operating turbine with the fewest carcasses. The aim was to investigate whether the turbine's location could provide insights, as some turbines are had higher bat carcasses counts near them.<br>The condition: Operating Turbine, with high carcass number showed consistently higher bat activity.<br><br>Our study validated the hypothesis that bats are more active near turbines than in areas outside the wind farm. Interestingly, activity levels varied among turbines, with some attracting more bats than others. During our visits, we observed numerous insects stuck to the turbines, which could be a key factor drawing bats to these structures. Additionally, we noted the presence of two nearby projects—a gas facility and a nuclear power plant—which for security reasons are surrounded with very bright lights. This suggests that bats in this wind farm might be seeking refuge from light pollution, making the turbines a more favourable habitat. Our suggestions are speculative and need more research particularly in different wind farms. |
| Develop an effective mitigation strategy to | | X | | A total of 88 bat carcasses were observed under the turbines, this |

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| prevent bat mortality | | | | number only correspond to a fraction of the bats that collide with the turbine blades. Major reasons are: (1) many of the carcasses are eaten/removed by scavenger animals, such as dogs, foxes and insects; (2) the surveys usually cover only a fraction of the surface where bats may fall; and (3) inevitably, some carcasses may go unnoticed by the surveyor.<br>To prevent bat mortalities, we recommend implementing targeted curtailment strategies from August to October, based on weather conditions. However, more extensive studies are needed to determine the specific weather conditions in which bats are most active, as our visits were insufficient to establish optimal parameters. Implementing curtailment under appropriate conditions could significantly reduce fatalities without major energy losses.<br><br>Additionally, we suggest light pollution reduction as a mitigation measure. In this project, bats may be displaced by bright lights from nearby industrial projects. Directing lighting downward to minimize sky glow could help reduce bat attraction to wind farms while also mitigating overall ecological disruption. |

**2. Describe the three most important outcomes of your project.**

**a).** A significant presence of bats was recorded in the project area. The Highest

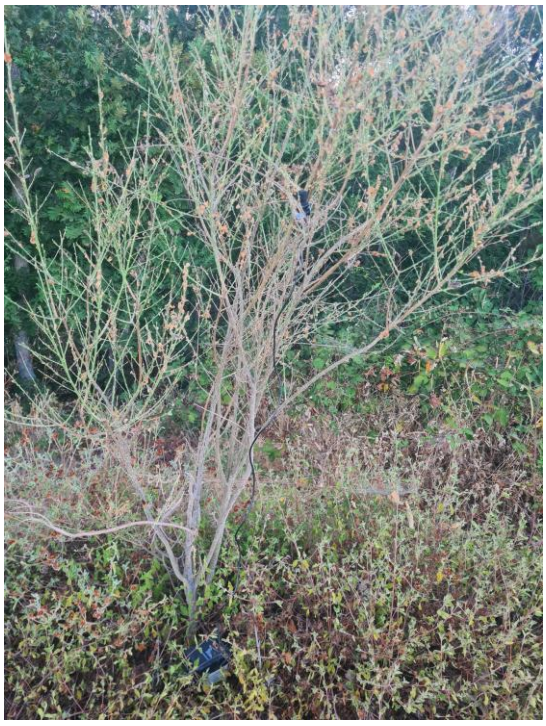
bat activity overall was in September and the lowest bat activity generally occurred in July. Species with high collision risk were recorded.

**b).** The condition: Operating Turbine, with High Carcass number showed consistently higher bat activity.
The hypothesis that bats are more active near turbines than in areas outside the wind farm was validated.
Bat activity levels varied among turbines, with some attracting more bats than others. We observed moths and insects stuck to the turbine's structures.
Bats in this wind farm might be seeking refuge from light pollution, making the turbines a more favourable habitat.

**c).** We created a website about bats and wind farms to help fill the knowledge gap in green energy projects and show their lesser-known effects.

We also wrote a manuscript that we plan to submit to peer-reviewed journals.

To help kids appreciate bats more, I wrote a story about bats facing turbines. The goal is to make bats more likable since they are often highlighted as vampires.



**These two photos showing the placement of the recording devices ( we tried to hide the devices as best as possible)**


**A photo showing the recording device. (This picture was taken when we checked on the devices the second day of recording)**

**A photo showing insects on the wind turbine**

**A photo showing the wind turbines from a far**

**A picture of me taken in the wind farm**

**3. Explain any unforeseen difficulties that arose during the project and how these were tackled.**

We did not encounter any significant difficulties during our visits. The only minor issue was a car problem on one occasion, but we were able to fix it.

For the children's book I wrote, I reached out to several illustrators, but some wanted very high prices. Finding an illustrator at a reasonable price was somewhat challenging.

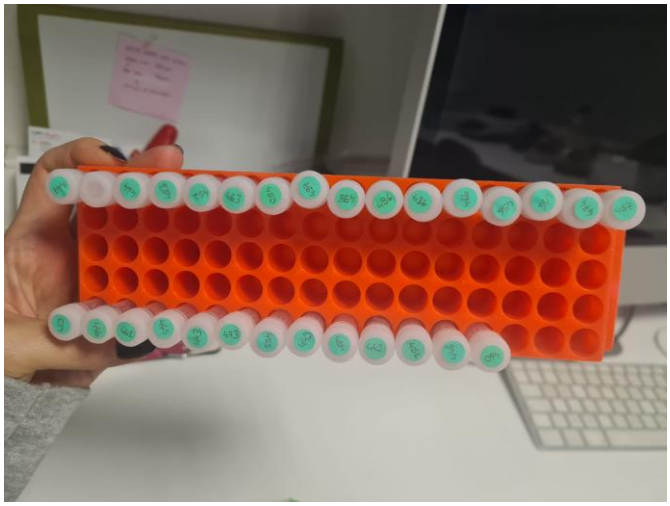
**4. Describe the involvement of local communities and how they have benefitted from the project.**

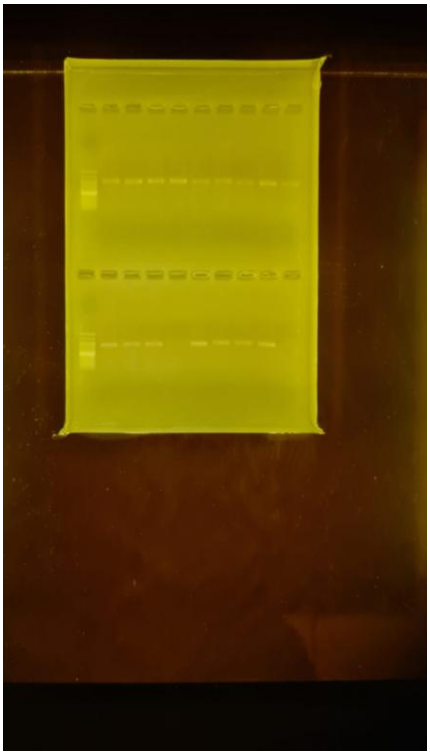
Our project actively involved the community by organizing guided walks to historical sites and the cave in Kiyikoy—though we didn't enter for safety reasons. During these walks, we shared information about bats, used binoculars for birdwatching, and engaged in discussions with locals about their perspectives on bats and wind farms. These conversations helped raise awareness about bat conservation and dispel common myths. Many questions revolved around the misconception that bats were responsible for the spread of COVID-19, and a common belief was that bats are merely virus carriers with no ecological benefits.

The project also engaged community members, including high school students, some of whom actively participated in our work. While we didn't have permission for them to enter the wind farm, two students assisted in the lab with DNA extraction, gaining hands-on experience in scientific research.

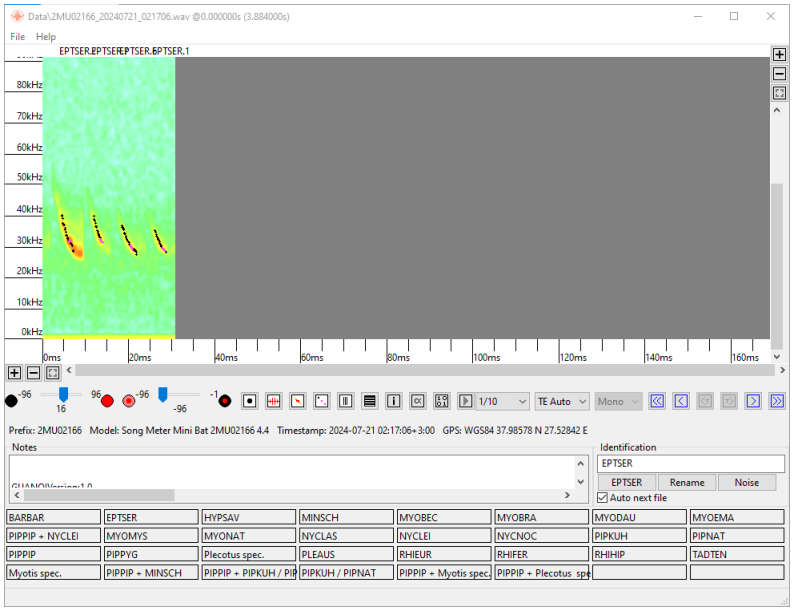
Beyond this, I wrote a children's book inspired by these experiences, and we are currently working on the illustrations. This book will help further promote awareness and conservation efforts among younger generations.

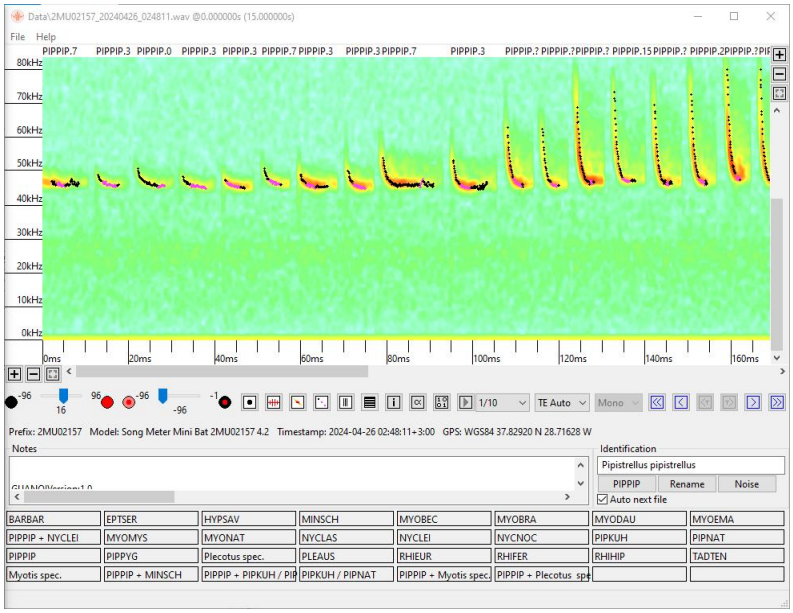
**These photos showing the two intern students who helped me with the DNA extraction of the samples**





**A picture on the left showing some of the bat samples. A photo on the right showing the PCR results.**






**These two pictures showing the bat calls of the bat sounds analysis step with Kaleidoscope Pro**

**A photo of the cave in Kiyikoy (this photo was taken during our guided walk)**

**A photo of a historical monuments in kiyikoy (this photo was taken during our guided walk)**

**5. Are there any plans to continue this work?**

Our study validated the hypothesis that bats are more active near turbines than in areas outside the wind farm. Activity levels varied among turbines, with some attracting more bats than others. During our visits, we observed numerous insects stuck to the turbines, which could be a key factor drawing bats to these structures. Additionally, we noted the presence of two nearby projects—a gas facility and a nuclear power plant—which for security reasons are surrounded with very bright lights. This suggests that bats in this wind farm might be seeking refuge from light pollution, making the turbines a more favourable habitat. Our suggestions are speculative and need more research particularly in different wind farms. we are willing to continue recording bat sounds in this wind farm and in other wind farms in Turkey.

This first project showed the efficacy of our workflow, we worked in one wind farm that has a "special position" and near two projects; to make a more accurate assumption, our work should be applied in other wind farms and in a longer recording days.

We see this project as a great opportunity to meet with people working in this field, that we don't have the opportunity to encounter in a university setting, such as birdwatchers and workers in other projects nearby. This field is still not well researched, especially in Turkey, there are many "reasonable" hypotheses that still need to be tested, such as the ones related to insects.

We intend to improve our work, make more realistic hypothesis and go step by step, and every work in this matter will be the seed for future works. For the children's book, we plan to make a hard copy of the book once we find a suitable publisher.

**6. How do you plan to share the results of your work with others?**

The outcomes of this project will be shared through multiple platforms to reach a diverse audience. We will publish updates on our website, and we already started

sharing field visit photos on our Instagram account. Additionally, we plan to engage with the professional community by posting results on LinkedIn.

During our fieldwork in Kıyıköy, we maintained close communication with the local community, ensuring that our findings were accessible to them. Furthermore, we presented our results at the journal club at the Institute of Environmental Sciences at Boğaziçi University, where researchers, research assistants, and interns had the opportunity to discuss our work and explore future directions.

Looking ahead, I plan to present this project at the Ecology and Evolutionary Biology Society of Turkey's symposium in July and at the Wind Energy and Wildlife Impacts 2025 Conference in September.

In addition, we have written a manuscript that we intend to submit to a peer-reviewed journal.

To extend our outreach beyond the scientific community, I have also written a children's book about bats. The final pages of the book include a summary of our project, making the information accessible to younger audiences and inspiring future interest in conservation.

**7. Looking ahead, what do you feel are the important next steps?**

1- Sharing our results through peer-reviewed publications will contribute to the existing literature and ensure that our work reaches scientists, conservationists, and policymakers who can use it to inform future studies and decision-making.

2- We aim to strengthen engagement with researchers, industry professionals, local communities, and the public, by being present more on digital platforms, participating in academic discussions, and creating more accessible content to bridge the gap between science and society.

3- To improve the accuracy and generalizability of our findings, we need to expand our study area beyond a single wind farm. Our initial research site had a unique geographical position near two projects, which may have influenced our results. Conducting studies in multiple wind farms and over longer recording periods will help us make more robust and representative assessments.

4- Engaging with experts from different fields, such as entomology, and environmental policy, will help us develop a more comprehensive understanding of the impact of wind farms on wildlife and the reason behind the presence of bats in these areas.

5- We plan to share our findings at national and international conferences, such as the Ecology and Evolutionary Biology Society of Turkey's symposium in July and the Wind Energy and Wildlife Impacts 2025 Conference in September. These events provide opportunities to receive feedback, network with other researchers, and explore potential collaborations.

6- Our findings can contribute to policy recommendations regarding wind energy and wildlife conservation. We plan to collaborate with environmental organizations, policymakers, and renewable energy stakeholders to advocate for sustainable solutions that minimize ecological impacts.

7- In addition to our research, we believe in the importance of education and awareness. The children's book that I wrote about bats is one example of how we are making scientific knowledge accessible to younger audiences. We hope to continue creating materials that inform and inspire future generations.

**8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?**

During the course of the work, we didn't send any photos, but we shared photos on our Instagram account and we are updating our public website. The logo of the Rufford foundation was used in the progress report of my thesis, in the presentation in the Journal club and in the children's book that I wrote, and in some photos on our Instagram account. The logo will be used in future presentations and in future publications.

**9. Provide a full list of all the members of your team and their role in the project.**

Onur Dogan: Onur is a PhD graduate from the Institute of Graduate Science, specializing in Marine Biology, at Istanbul University. He has worked on several research projects and was awarded the Rufford fund for his project under the title: "Assessing DNA-based biomonitoring applications in the Golden Horn (Istanbul, the Marmara Sea)". He assisted our team in organizing the workflow of the project. He also helped me look for illustrators and gave me some advices about my children's book.

Cem Akin: Bird Watcher
Cem Akin worked as a bird watcher at Borusan EnBW Energy company. He has a bachelor's degree in Geology from Karadeniz Teknik University as well as a bachelor's degree in business and management from Anadolu University. As a bird watcher at the Kıyıköy wind farm, Cem assisted in monitoring bat fatality and collected samples from dead bats and sent them to the lab for analysis. Additionally, Cem is a professional wildlife photographer, and he assisted in taking photographs for the project, including those for the website and the Instagram page.

Emre Cetin: Bird Watcher
Emre Cetin is a bird watcher at Borusan EnBW Energy company. He has a bachelor's degree in fine arts from Mimar Sinan Fine Arts University. His role at the Kıyıköy wind farm involves assisting with monitoring bat fatality and collecting samples from dead bats. Emre assisted in monitoring bat fatality and collected samples from dead bats and sent them to the lab for analysis. Additionally, Emre was the one using the car in the wind farm and assisted with placing the recording devices.

Gökçe Akgül: He is an Illustrator from IstanbuL. He provided illustration services for my children's book, and he also helped with editing the story.

Merve sivaci: Merve is PhD graduate from the institute of Environmental sciences at Bogazici University, her PhD title was Comparison of the Genetic Diversity Levels of Wheat Species Grown in Turkey & Investigation of the Genomic Responses of Local Einkorn Wheat to Heat Stress. She is currently doing a postdoc at Ankara University funded by Tubitak. She helped with writing and discussing the outcomes of the project. She also helped with doing the PCR of some samples in the lab.

**10. Any other comments?**