



State of the science: Technological solutions to estimate bird and bat take at offshore wind facilities

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BACKGROUND

In October 2021, US Fish and Wildlife Service published a notice of intent to explore the possibility of authorizing incidental take under a Migratory Bird Permit and is considering developing individual, general-permit-authorization regulations for offshore wind power generation facilities. Wind power developers onshore have experience working with USFWS to develop regulatory requirements for birds and bats under the Endangered Species Act and Bald and Golden Eagle Protection Act, all of which include mortality reporting requirements, often fulfilled via carcass detection surveys. However, a survey method for measuring take is impractical in the offshore environment and necessitates the development of alternatives to document solutions. Additionally, the high cost of conducting such surveys, even onshore, has further driven the development of technological solutions to monitor bird and bat take remotely.

OBJECTIVE

To provide a summary of the monitoring technologies currently available or in development appropriate for documenting take under the Migratory Bird Treaty Act.

METHODS

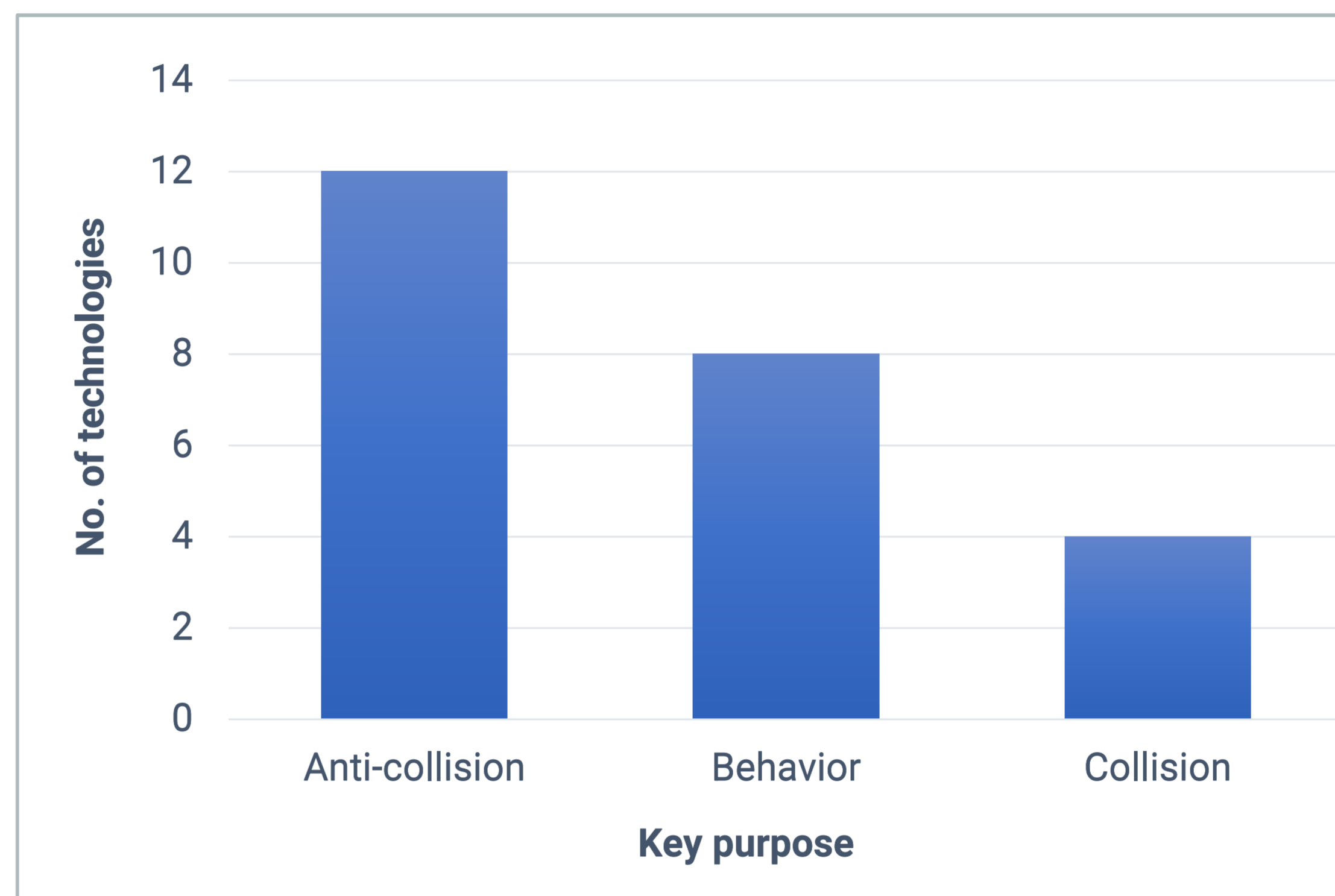
To review the available technologies we:

- Reviewed wind mitigation technology databases and wind-wildlife conference proceedings.
- Included solutions that could record collisions in real-time-strike detection technologies and image/video monitoring systems.
- Excluded radar or telemetry-based systems.
- Used developer-provided information from REWI's technology catalog to provide TRL status as available.
- Evaluated technologies based on commercial-readiness, proof of validation, mode of detection, and purpose.

RESULTS

We evaluated 100 technologies aimed at monitoring activity of birds and bats around wind energy infrastructure, and found:

- 25 technologies with the capability to detect collision events in real-time.
- 4 technologies have been developed with the specific intent to detect collision events, though others may be capable of detecting collisions with modifications.
- Only 3/4 can attribute to species.
- Only 1/3 has been tested offshore.
- 0/3 are able to detect collision events for birds and bats under 50 g.
- Remaining technologies are intended to detect birds for behavior and risk assessment or curtailment and deterrence.
- Commercial availability was not necessarily indicative of peer-reviewed field validation.



Key purpose of technological advancements to monitor bird activity around wind turbines. Anti-collision refers to technologies developed to detect birds for the purposes of initializing curtailment or audio/visual deterrents. Behavior refers to technologies developed to evaluate bird behavioral responses to turbines (e.g., avoidance, flight height). Collision refers to technologies developed specifically to detect and record collision events.

Name	Developer	Description	Comm. avail.	Published studies	Video	NIR	Detection method	TRL	Key limitations
B-finder	EMPEKO	Detects falling objects using a series of cameras located at three different heights along the turbine tower.	Yes	Bfinder Team EMPEKO S.A. (2019)	Yes	Yes	Visual	9	Detection range ≤100 m for big birds and ≤50 m for small birds
ID-Stat	Norwegian Institute for Nature Research	Uses microphones embedded within turbine blades to detect collision events	No	N/A	No	No	Acoustic	1	Cannot attribute collision event to species. No information on pilot testing after 2011 announcement.
Wind Turbine Sensor Unit for Monitoring Avian and Bat Collisions (WTSU)	Oregon State University	Detects collision event using both microphones and accelerometers embedded in turbine blades to detect collision events and video/audio recordings to confirm species	No	Hu et al. (2018)*	Yes	No	Acoustic and Accelerometer	N/A	Not yet tested with thermal integration. Not yet tested for sensitivity to smaller birds/bats.
WT-Bird	Energy Research Centre of the Netherlands (ECN)	Detects collisions for a wider range of birds/bats using blade-embedded microphone and camera system.	Yes	Wiggelinkhuizen et al. (2006)	Yes	Yes	Acoustic	6	Detection for birds ≥50 grams. Cameras not yet tested

*Indicates a study published in a peer-reviewed scientific journal.

CONCLUSIONS

We do not yet know which requirements USFWS will set as part of incidental take permits for wind energy operators, however quantifying take from collision and displacement may be an important aspect. Automated detection technology will further be necessary to validate minimization strategies for offshore wind turbines. Some technologies exist to observe bird and bat behavior in relation to turbines, many of which may capture collision events via video recordings. However, **there are no commercially available technologies designed to detect collision events and assign them to bird and bat species in the offshore environment.** Two technologies are currently in development, which can detect collision events and assign them to species. Only one of those technologies has been tested offshore, and none is currently able to detect collisions from animals under 50 grams. Meeting regulatory (and stakeholder) expectations will **require continued support to further development of necessary technologies and make them commercially available.** Additional research will be required to provide wind energy operators with best methods for deploying monitoring technologies in the field, once suitable technologies are identified.

ACKNOWLEDGMENTS

We thank American Clean Power Association for their generous in-kind donation to REWI, which provided the cost of registration to attend this conference.

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