TIDAL POWER TURBINE
FISH INTERACTION MODEL

Kleinschmidt

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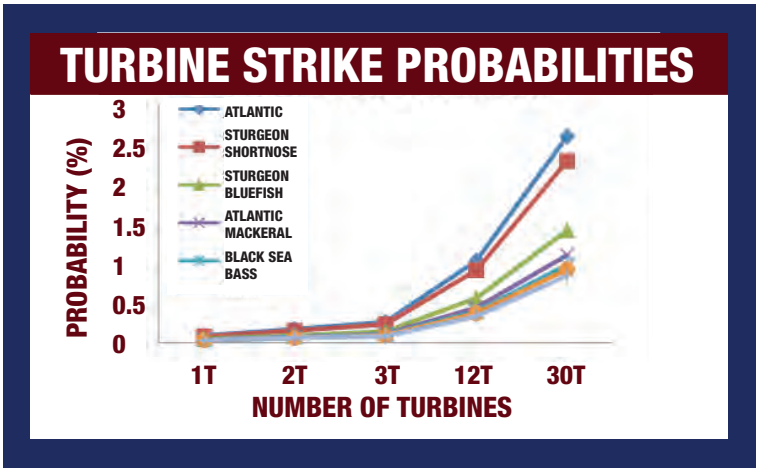
Kleinschmidt engineers and biologists recently collaborated with Verdant Power, LLC on the development of the **first in-stream kinetic hydropower turbine fish interaction model, which was accepted by the Federal Energy Regulatory Commission (FERC) and federal and state regulatory agencies.** The probability based model quantifies the risk of a turbine blade striking a fish at the proposed Roosevelt Island Tidal Energy (RITE) pilot project located in the East River, New York City.

The proposed project features a phased development of up to thirty, 5-meter diameter axial flow turbine generator units with a total capacity of 1 MW. The project will start with 2 turbines initially planned for installation and validation, followed by additional turbines being added in a staged approach. This model was developed as part of an endangered species assessment for the National Marine Fisheries Service (NMFS) for the shortnose and Atlantic sturgeon that may transit the East River.



Specifically designed to concentrate on the turbine interaction with the shortnose and Atlantic sturgeon, the model also generates comparative results for several fish species identified in the Essential Fish Habitat Assessment. The model takes a probabilistic 2D approach and considers the strike on an individual from a single turbine only, which is then multiplied to determine the effect of multiple turbines up to the number required for proposed project. The model is simple, verifiable and defensible, determining strike likelihood by combining various parameters, including:

- water velocity distribution;
- channel geometry;
- physical and operating characteristics of the turbine; and
- specific fish characteristics (size, burst speed, and swimming velocity in relationship to water velocity).

The model does not contain assumptions on fish behavior, assuming that

- the fish transit the channel,
- there is an even distribution of individuals, and
- that there is no avoidance behavior.

Nevertheless, the model does contain provisions to incorporate these parameters as they become known through environmental monitoring studies during the term of the RITE project license.

The model results indicated that the probability of an individual fish being struck by a turbine is low. Atlantic sturgeon was the largest fish modeled and has the largest strike probabilities, ranging from 0.09 percent for 1 turbine to 2.59 percent for 30 turbines. Other species strike probabilities varied from 0.08-2.28% for shortnose sturgeon to 0.03-0.84% for Atlantic herring. The model considers only blade strike. Fish mortality due to strike could be considered much lower due to the slow rotational speed of the turbines (approximately 35 rotations per minute).

The model and results were submitted to FERC as part of the pilot license application for the RITE Project. FERC accepted the model concept and results, submitting it to NMFS as part of the licensing process. Based on this model, NMFS has issued a Biological Opinion approving the RITE Project as **"not likely to adversely affect" listed species under their jurisdiction. The New York State environmental agencies also concurred with this finding.**

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