

AN ENERGY HARVESTING UNDERWATER ACOUSTIC TRANSMITTER FOR AQUATIC ANIMALS

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Autonomous electronic devices, especially micro devices, are limited by the finite energy capacities of their batteries. For an underwater acoustic transmitter, the weight and volume associated with the battery are the limiting factors in transmitter operational life, which subsequently affects the length of time the tagged animal can be studied. In this work, for the first time, we successfully developed and demonstrated a self-powered acoustic transmitter that used a piezoelectric composite beam to harvest the mechanical energy from the swimming motion of a live juvenile sturgeon, in which the transmitter was implanted subdermally. The self-powered transmitter did not contain a primary battery and was able to consistently send transmissions when the implanted fish swam in a natural manner. The prototype transmitter is 77 mm long, 5.3 mm wide, only 1 mm thick for the most part of its body. It weighs no more than 1 gram. This is the first implantable self-powered device that has been successfully demonstrated in a live fish. The successful development of this transmitter has potential to significantly expand our capabilities in long-term aquatic animal tracking and their migration behavior studies.



Bio

Dr. Deng is a Lab Fellow in the Energy and Environment Directorate at the Pacific Northwest National Laboratory and an adjunct professor of Mechanical Engineering of Virginia Tech. He directs the PNNL Bio-Acoustics & Flow Laboratory, an accredited multi-disciplinary R&D laboratory, addressing a broad range of engineering and ecological issues, with an emphasis on environmental monitoring and risk assessment for hydropower, wind, marine, and hydrokinetic energy systems. He has authored or coauthored 120 peer-reviewed journal articles. He has developed several licensed technologies related to renewable energy and acoustic sensors. He has six patents and seven pending patent applications. He received his PhD in Theoretical & Applied Mechanics from University of Illinois at Urbana-Champaign in 2003.