Smart panel for detection and deterrence of sea lampreys

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ABSTRACT:

This project sought to advance smart sensing panels for detecting the suctorial attachment of sea lamprey. Such panels could have myriad applications in sea lamprey assessment and control, e.g., enabling selective fish passage, providing trap-free relative abundance estimate, and informing seasonal barrier operation. The study focused on improving two smart panel technologies, one based on piezoresistive (PR) pressure sensor array and the other based on interdigitated electrode (IDE) contact sensor. For the PR pressure sensor, a cost-effective rapid fabrication method was developed that reduces the time of making a panel to 15 minutes. A computer vision-type machine learning approach was proposed and implemented for automated detection of lamprey attachment, by utilizing the features of pressure profiles resulting from lamprey suction. For the IDE sensor panel, multiple machine learning classifier models were trained and implemented on an Arduino board, and their real-time lamprey detection capabilities were demonstrated in animal experiments. Finally, the response of sea lamprey to an applied electric field was examined in detail, which produced new insight into electric shocking as a potential lamprey blocking/deterrence mechanism.