A STREAMLINED AND STANDARDIZED BENTHIC HABITAT MAPPING APPROACH FOR MARINE AND HYDROKINETIC SITE ENVIRONMENTAL ASSESSMENTS

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With funding from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Integral Consulting Inc. is developing and testing a standardized benthic habitat mapping tool set for MHK sites that uses rapidly obtained sediment profile image (SPI) and plan view (PV) image data to ground truth multibeam echosounder (MBES) bathymetry and backscatter seafloor maps (Figure 1). Benthic habitat maps generated for two different 7–8 km^2 areas near Sequim, Washington, in 2017 and 2018 will be presented to illustrate the effectiveness of this approach across a range of environmental conditions (i.e., low to high energy settings).

A primary technological innovation developed as part of this study is the development of a computer vision system for automating the extraction of key physical and biological measurements from the SPI and PV images. The image analysis system uses a unique combination of machine- and deep-learning techniques (e.g., convolutional neural networks) for grain-size classification, interface delineation (e.g., the sediment–water interface), and object detection (e.g., identification of organisms and biogenic structures). The data generated from the automated system is consistent with the data generated manually by a trained image analyst and is obtained more rapidly. The data obtained from the images in this supervised, automated fashion using our computer vision system are used to inform the interpretation of the acoustic maps (e.g., substrate textures), as well as to provide information on benthic ecological and other biological features. The collection of physical and biological sediment data from images rather than bottom samples allows for a higher density of ground truth data points and spatial coverage.

The combination of rapid seafloor mapping technologies and the computer vision system for image data generation makes this habitat mapping approach both cost-effective and repeatable as a first tier methodology for conducting environmental assessments at MHK sites.

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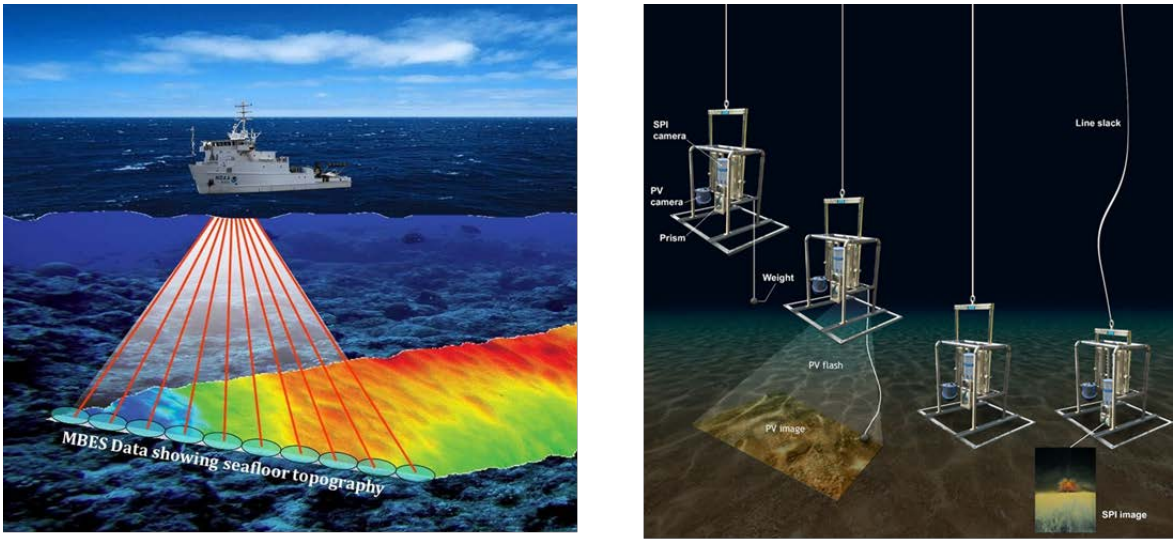

FIGURE 1. MBES DATA (TOP LEFT) IS GROUND TRUTHED WITH SPI/PV SEDIMENT DATA (TOP RIGHT) TO RAPIDLY PRODUCE A STANDARDIZED SUBSTRATE COMPONENT MAP (BOTTOM).