**The value of incorporating bearing estimation into real-time right whale mitigation systems**

**Abstract**

There is a need to implement effective conservation measures for right whales while minimizing negative impacts on stakeholders including the fishing, shipping, and burgeoning offshore wind industry. Exclusion and mitigation zones are a common conservation method that limits potentially harmful activities such as pile driving or ground fishing when right whales are in the area. SMRU Consulting has built the Coastal Acoustic Buoy for Offshore Wind (CABOW) to address the need for exclusion zone mitigation. Each CABOW consists of a bottom lander with three hydrophones; data acquisition system; and onboard computer running PAMGuard. The CABOW detects potential calls and relays clips to a base station for classification, bearing estimation, and validation. Bench testing characterized detector performance and measured bearing accuracy as a function of SNR. Field trials used playbacks of real and simulated right whale upcalls to evaluate the detection probability with respect to the range and signal excess of the call; estimate bearing accuracy; and test the range and stability of the radio communications. Field trials indicated a maximum detection range of 4-12km under high and very low noise levels, respectively. Last, we used a simulation to compare true and false alarm rates of the CABOW to an equivalent single sensor system for monitoring a fixed area. Simulations show that incorporating bearings to calling animals could provide a substantial improvement in false alarm rates relative to single sensors if properly placed with respect to potential noise sources.