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Computational Predictions of sonar performance based on full wave acoustic propagation modeling

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For fishery acoustics, sonars offer the advantage of inferring the biomass of a given ocean volume at a lower operational cost of traditional echo-sounders, but wave guide effects which induce multi-pathing yield unknown variances in bio-mass estimates. A sonar performance model has recently been developed to assist in understanding this variance based on the para-axial approximation to the acoustic wave equation. The model takes into account the geometry of the sonar deployment (source depth, transmit/receive beam patterns, pulse shape) and the acoustic environment (water column and geo-acoustic bottom) and creates a data base of two-way transfer functions for a chosen set of range-depth cells. Then, given a hypothetical aggregation or school of fish, each with its own target strength, as well as noise and reverberation levels, one can create intensity maps which can be used to perform sensitivity studies to ascertain the performance characteristics of a fishery sonar. This talk will discuss the theoretical development of the model, its constraints, and provide an example which highlights its potential for future work. The example will be in a shallow water (100 m) environment using acoustic frequencies of around 10 kilohertz for imaging aggregations of pelagic fish. The Naval Ocean Partnership Program is gratefully acknowledged for this work.