The potential application, and value, of using acoustic methods to map and monitor sub-seabed material found on maritime archaeological sites have been previously identified. Despite their apparent significant advantages, practitioners have not widely adopted in situ management approaches, and the concurrent use of sub-bottom profilers (SBPs). This work extends the application potential of parametric acoustics to in situ management at sites that are potentially 'at risk' from degradational loss of shallow-buried material, and provides a basis for greater practitioner uptake. In addition, for archaeological research planning purposes, preliminary non-invasive SBP data improves the efficacy of subsequent site investigations. The performance of a parametric SBP was assessed in situ on two control sites and on the historic *James Matthews* (1841) shipwreck site, against process driven data requirements from in situ preservation and research frameworks. At these control sites, multiple timber and ferrous 'sleepers' were purpose-buried in different configurations at a range of depths in different sediment environments. Performance attributes associated with the accuracy and reliability of locating buried timber, metal, slate and ballast stones, estimating their depth of burial (DoB) and identifying the lateral extent of a complex shipwreck site were quantified. Measurements of DoB for the keel, ribs and planking timber on the *James Matthews* shipwreck site identified a high risk of ongoing materials degradation, confirmed by previous independent testing. Reflection coefficient analyses based on in situ measurements differentiated the density, and hence degradation state, between the fully saturated and degraded oak timbers found on *James Matthews* and the adjacent partially saturated oak used in the buried sleepers. These analyses also demonstrated that the orientation of the wood buried in the sediment had minimal influence on DoB estimates, and confirmed earlier laboratory-based conclusions that wood orientation may not influence the magnitude of reflection coefficients calculated from in situ acoustic measurements. These are key outcomes since, a priori, the likely grain orientation of buried shipwreck timbers is unknown when gathering initial site data. Acoustically derived reflection coefficients, plotted against the known relationships between DoB, sediment dissolved oxygen profiles and degradation potential for a site, provide a tentative model with which to interpret in situ conditions. These validated outcomes reveal that the performance characteristics of the parametric SBP, utilised in archaeological applications, provide data which supports the theoretical frameworks for the protection of UCH derived from the 1992 European Valetta Convention and the UNESCO 2001 *Convention on the Protection of the Underwater Cultural Heritage*.