

## 21. Basic Underwater Acoustics: The Effects of Boundaries

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Underwater sound waves behave differently when they are produced inside pools, tanks, or waveguides in a laboratory, and in small bodies of water or shallow water near shore when the acoustic wavelength is about the same order of magnitude as the water depth. In these situations the commonly used relationships for change in sound pressure level with distance from the source such as spherical spreading, and calculation of acoustic particle velocity and sound intensity from sound pressure do not hold. In fact, in some cases the speed of sound in water can be even lower than the speed of sound in air! But underwater acoustic communication experiments often take place in enclosed chambers or small lakes or estuaries, where it is quite difficult to predict the sound pressure and intensity at a receiver that is located some distance away from the source. The caveats of doing underwater experiments in confined locations will be discussed and the physical effects of boundaries on the sound field will be presented. Mathematical relationships that can be used to calculate acoustic particle velocity and intensity from sound pressure measurements will be developed from physical laws for these situations and their use will be illustrated with experimental data.