Mark Delaplaine

From: WEMAI@aol.com
Sent: Monday, May 10, 1999 10:02 AM
To: mdelaplaine@coastal.ca.gov
Subject: Inquiry re transmission loss

Mark,
1. I have no problem with the higher attenuation [TL > 20Log(R)] discussed in the USGS writeup. However, these values are based on a curve fit of data extending out several km or more from the source.
2. If the issue is levels at very close ranges out to say a few hundred meters, than I would be uncomfortable using these long range extrapolations. Until there is a boundary interaction, one must use 20 Log(R) as the loss from a single omni-directional source. Once there is boundary interaction than the potential for greater losses (due to boundary interaction with the acoustic spreading and absorption losses) can exist.
3. Related issues: There are three potentially confounding issues here:
a. Beam Forming - If the seismic source being used is an array of sources, than there is some beamforming involved as well. I discussed this at the HESS workshop on acoustics. The quick assessment here is to take the single loudest source in the array and assume the receive level nearby (Out to a range = water depth) is its source level - 20Log(R).
b. Shallow receivers - Near the ocean surface an effect called LLyod's Mirror occurs. This is a phenomena resulting from constructive and destructive interference of sound waves bouncing off of the surface. This also can cause variations from 20Log(R) spreading, especially if the receiver (animal) is relatively shallow. A good handbook like Urick has an adequate description of this phenomena. Animals within say 1/12th of a wavelength of the surface will hear a substantially reduced acoustic field due to the free surface.
c. Source Frequency - There is no mention in the USGS study of the change in TL with frequency. Bottom properties are highly frequency dependent and it may be that as higher frequency components of the source spectrum are examined they will show a different attenuation factor. USGS is probably addressing only the primary part of the spectrum (50 Hz or so?)

In summary, I would be suspicious of applying the 25 Log(R) across the board to all situations, especially those where the animals are within a few hundred meters of the vessel and in relatively deep water.

Hope this is helpful.
Bill E.