Effect of Sound on the Marine Environment

- Marine mammals exposed to high-intensity sound sources may experience permanent or temporary hearing impairment, or alter their normal behavior patterns (feeding, mating and nursing, etc.).
- Environmental Impact Statements are required to anticipate the number of affected mammals (“takes”) in the marine environment.
- The NEAR-Lab is developing computer modeling techniques to quickly and accurately estimate acoustic exposure in the marine environment.

Photo source: http://www.bio.davidson.edu/people/vecase/behavior/Spring2004/morse/social%20spacing.htm
Acoustic Exposure Thresholds

Energy Thresholds (SEL):
- Permanent Threshold Shift (PTS)
- Temporary Threshold Shift (TTS)

Intensity Threshold (SPL):
Harassment resulting in behavior changes (according to risk function)
Comparing Movement vs Static Approaches

Primarily two approaches are being used or considered for impact studies:

1. Animat Method
   • Monte Carlo technique
   • Simulated animals, or “animats”, are moving in time.
   • 4D (range, bearing, depth, time)

2. Static Distribution method
   • Based on histogram distributions
   • No time dependence
   • 3D (range, bearing, depth)

*Biomimetica, San Diego, CA
Modeling Transmission Loss

- Sometimes TL is complicated by effects such as surface ducts or bathymetry
- These can change over time and range
- Uniform grid of the simulation space is computationally intensive
- Adaptive Mesh Refinement (AMR) allows risk to be evaluated more quickly

• S. Schecklman, Dorian Houser, Matthew Cross, Dan Hernandez, Martin Siderius, *Comparison of methods used for computing the impact of sound on the marine environment*, submitted to Marine Environmental Research, 2010.