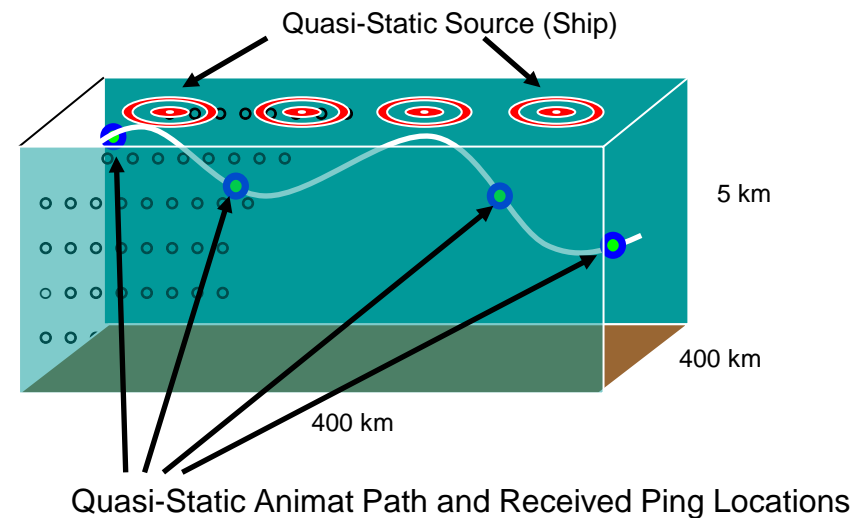


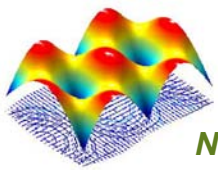
Effect of Sound on the Marine Environment

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- 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.**





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Acoustic Exposure Thresholds

Energy Thresholds (SEL):

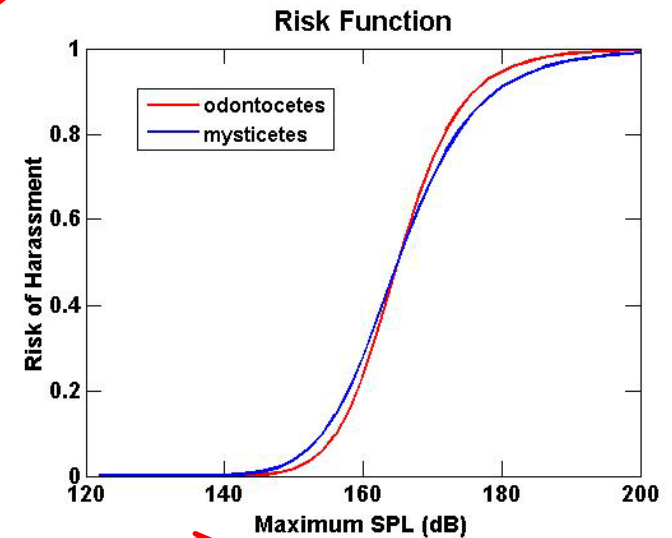
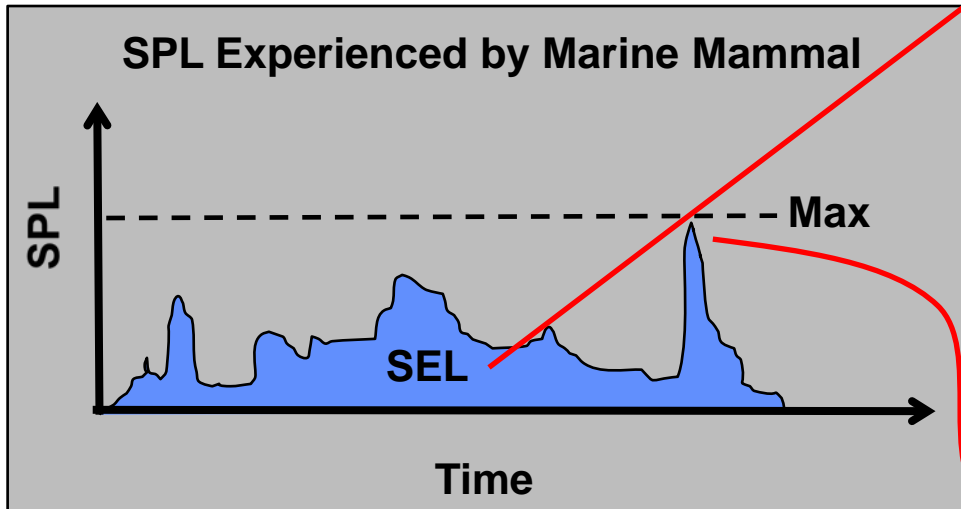
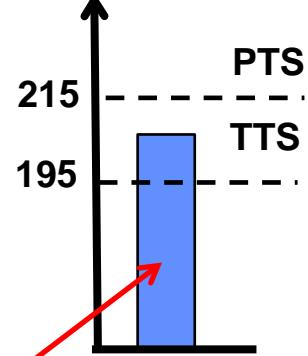
Permanent Threshold Shift (PTS)

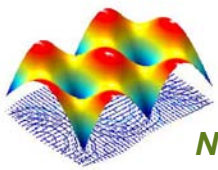
Temporary Threshold Shift (TTS)

Intensity Threshold (SPL):

Harassment resulting in behavior changes
(according to risk function)

SEL (dB re: 1 μ Pa)





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Comparing Movement vs Static Approaches

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

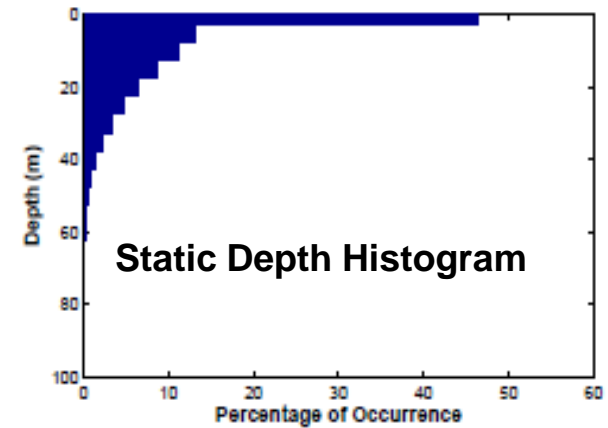
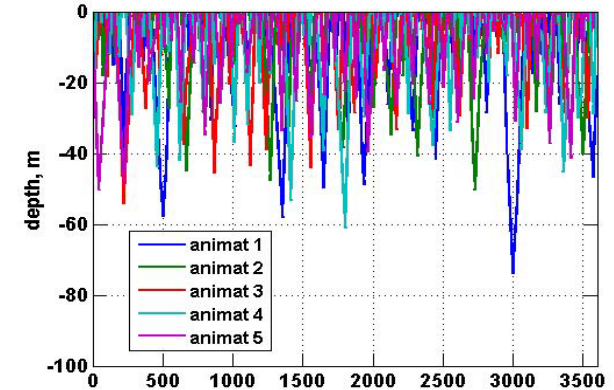
1. Animat Method

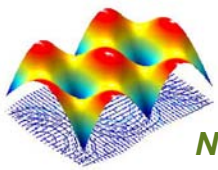
- Monte Carlo technique
- Simulated animals, or “animats”, are moving in time.
- 4D (range, bearing, depth, time)

2. Static Distribution method

- Based on histogram distributions
- No time dependence
- 3D (range, bearing, depth)

Shallow dive patterns (3MB*)

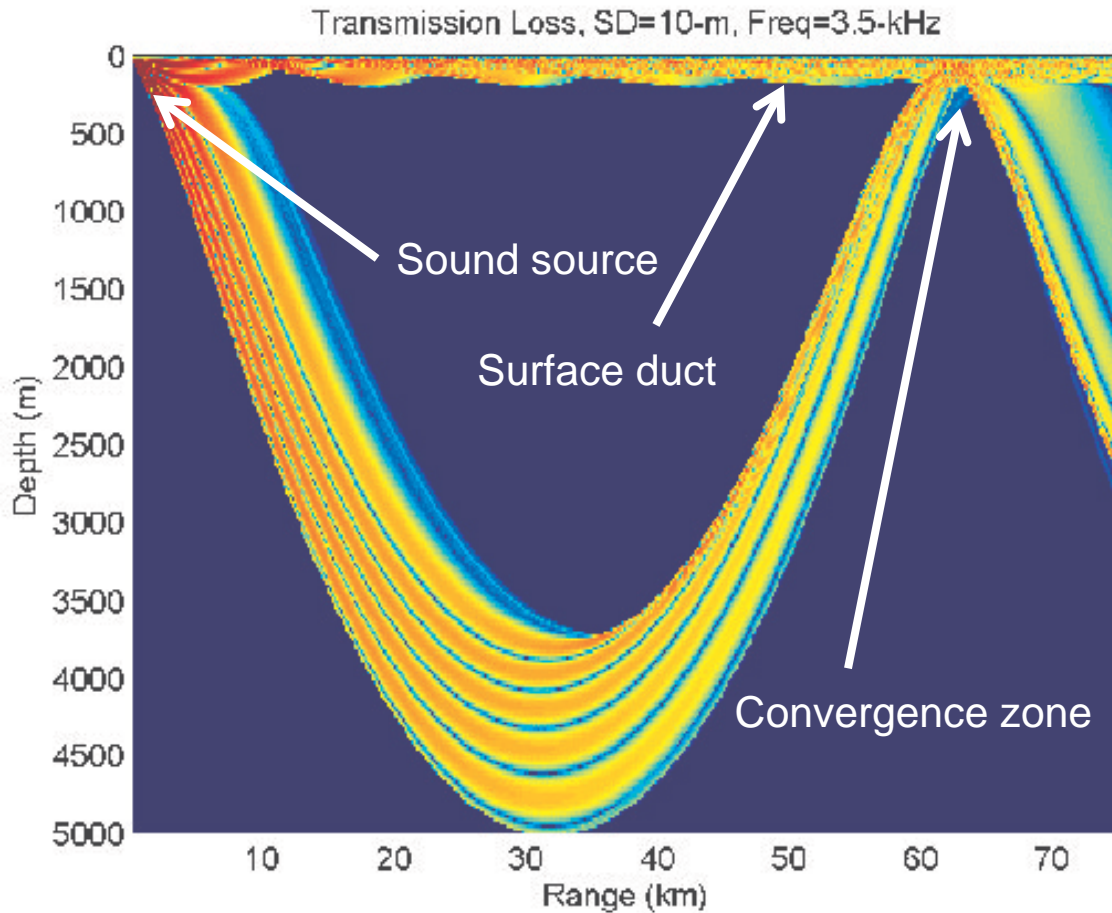




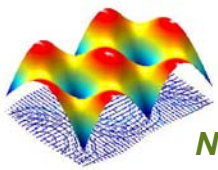
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Modeling Transmission Loss



- 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



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Publications

- S. Schecklman, M. Siderius, and D. Tornquist, *Computing the effect of sound on the marine environment by the adaptive mesh refinement method*, submitted to IEEE Oceans, Seattle, 2010.
- 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.