Large Vessels as Sound Sources I: Radiated Sound and Ambient Noise in Nearshore/Continental Shelf Environments

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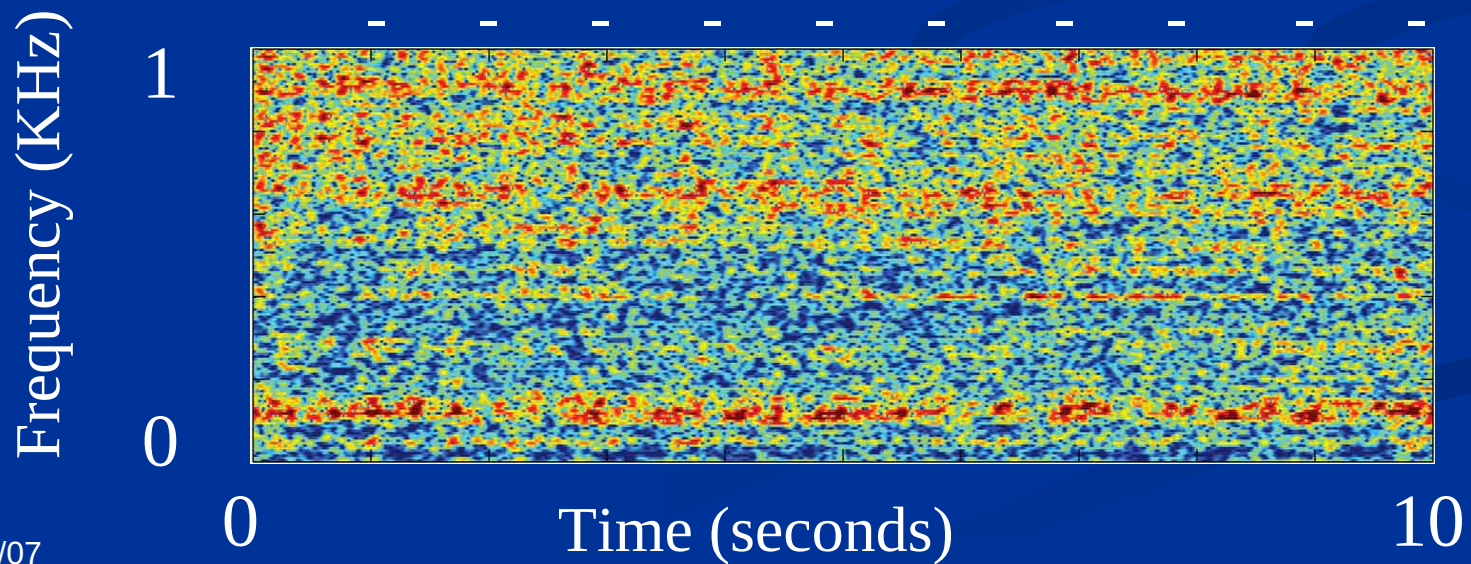
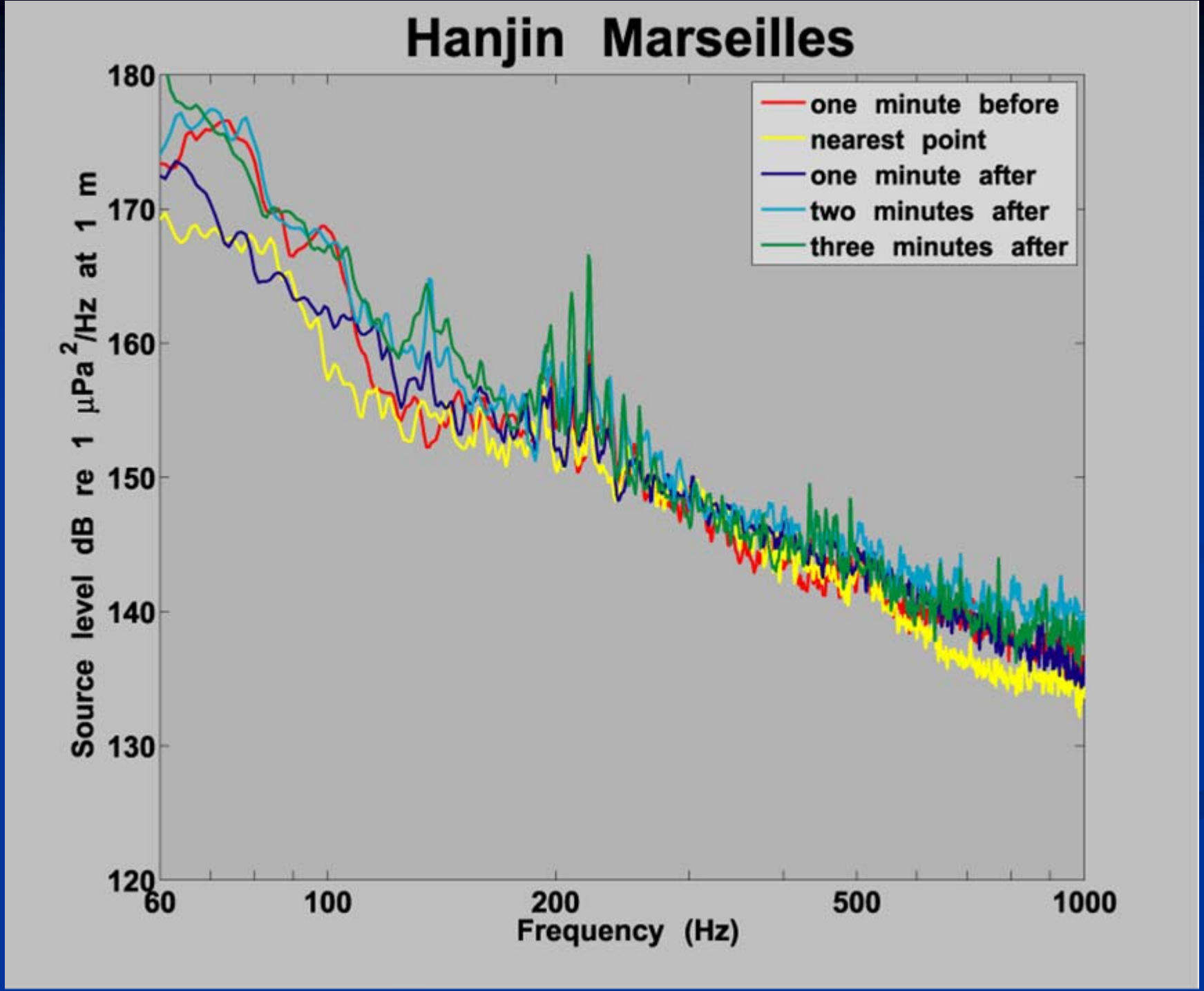
Ambient Noise from Shipping



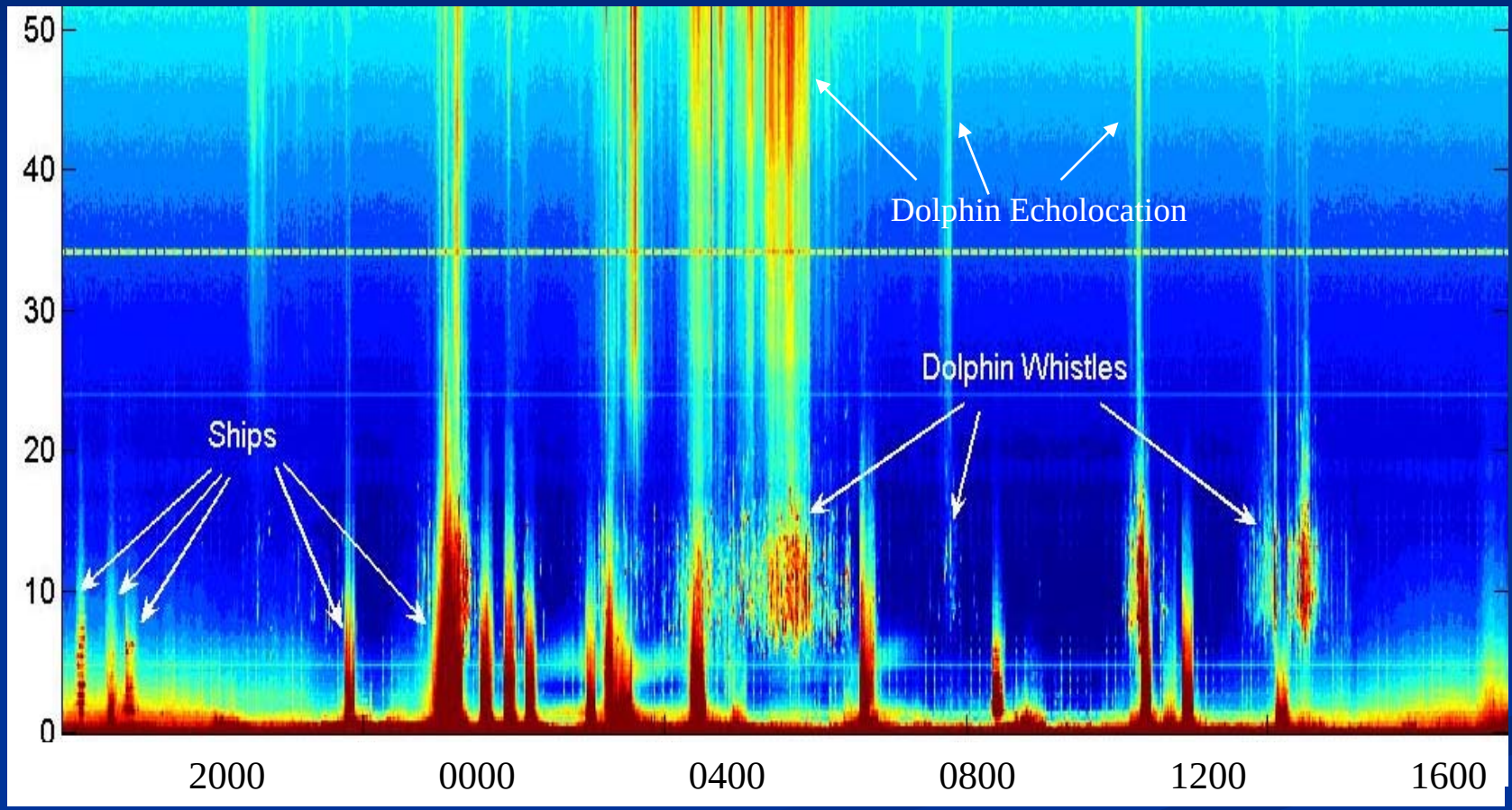
Ambient Noise from Shipping

Container Ship - Hanjin Marseilles

51,299 Gross Ton Container Ship


Hanjin Marseilles
one minute before
nearest point
one minute after
two minutes after
three minutes after
Source level dB re 1 μPa²/Hz at 1 m
180
170
160
150
140
130
120
60
100
200
500
1000
Frequency (Hz)

Shipping Noise in the Santa Barbara Channel



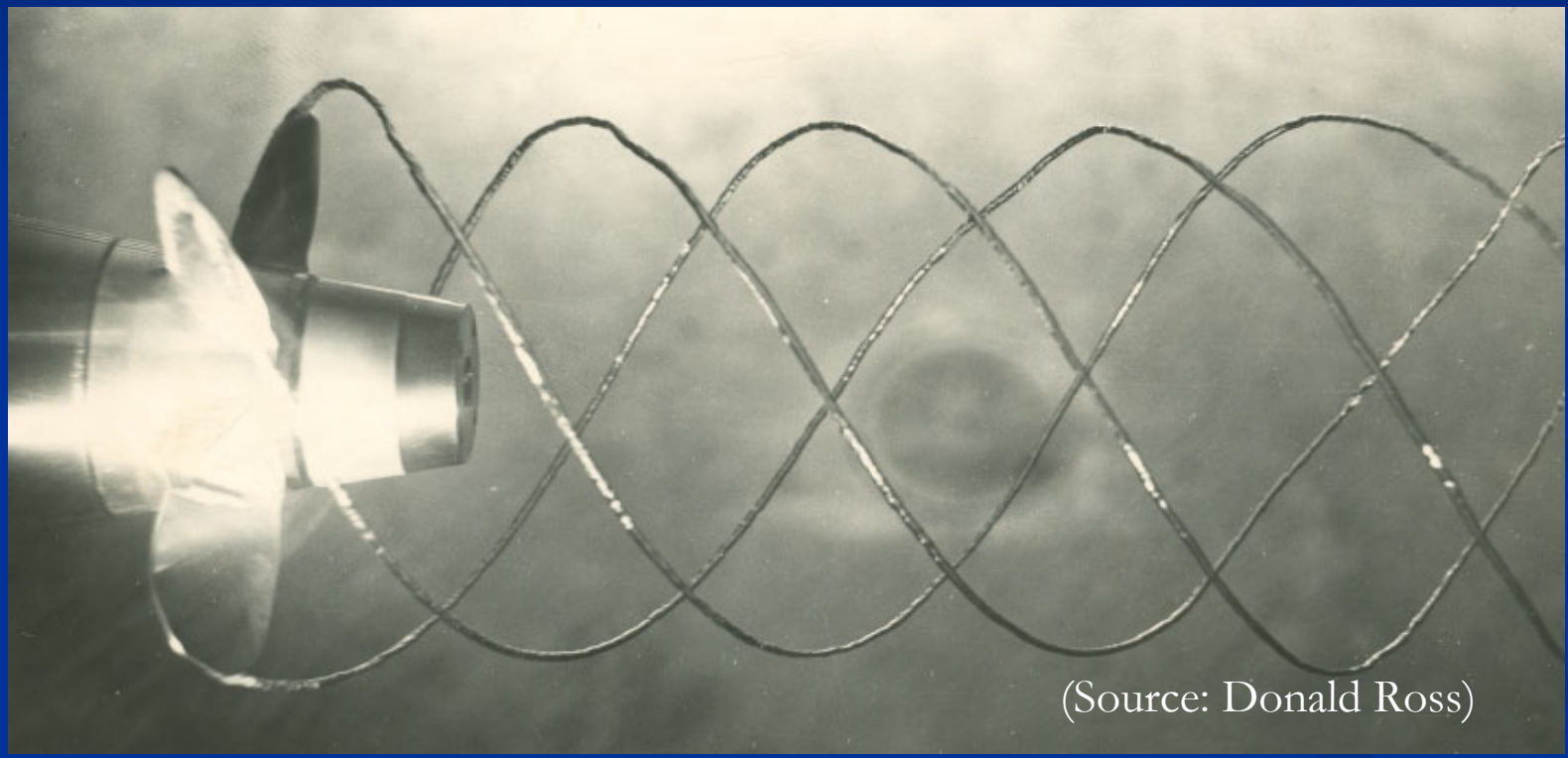
Ship Noise Sources: Propellers

Dominant Source of Radiated Underwater Noise for Surface Vessels

- Cavitation Blade Tonals - Blade Passage Frequency and Harmonics
- Propeller Cavitation Noise - Broad Spectal Range

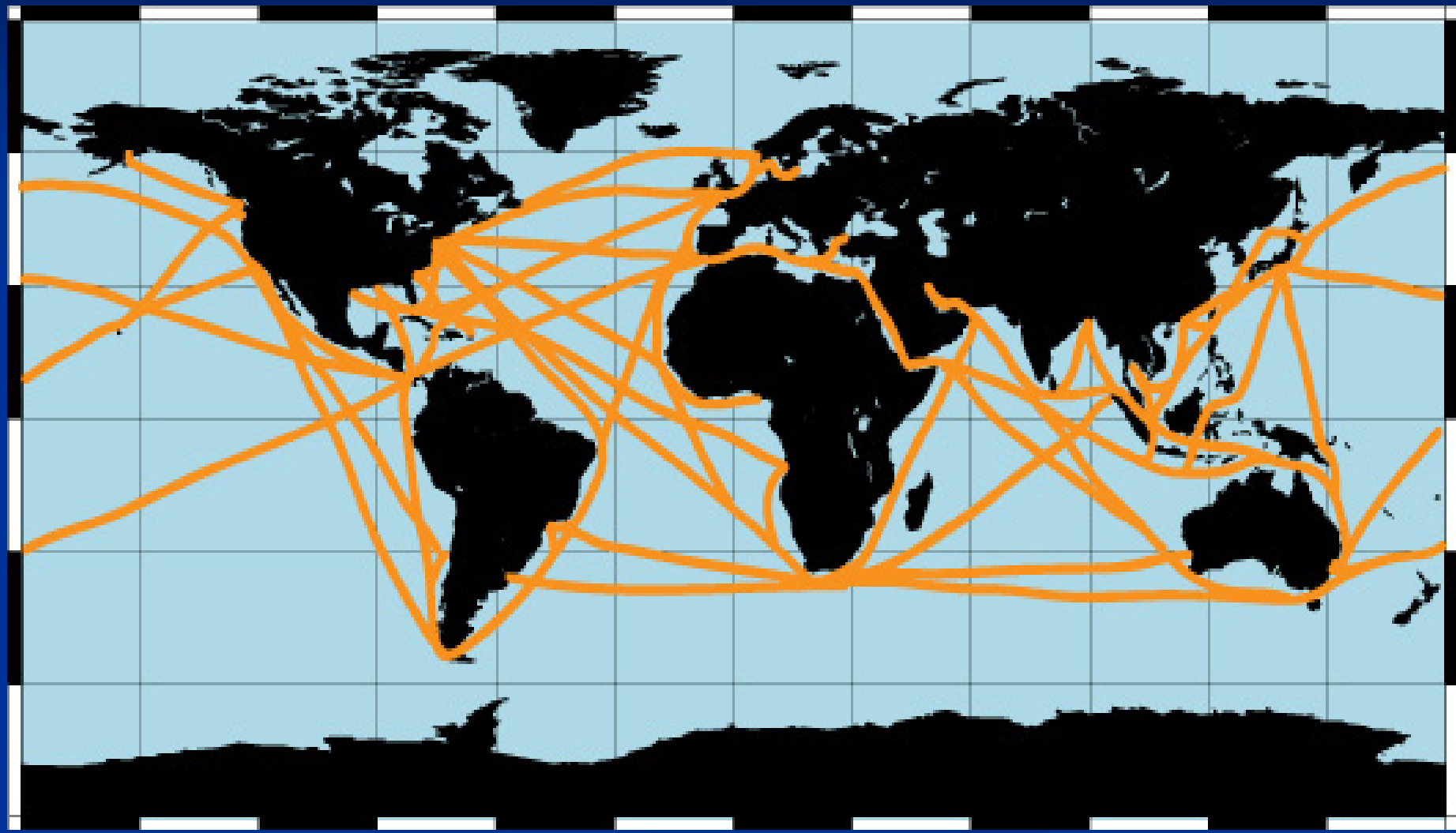
Sources of Ship Noise: Cavitation

Cavitation: rupture of a liquid or a liquid-solid contact

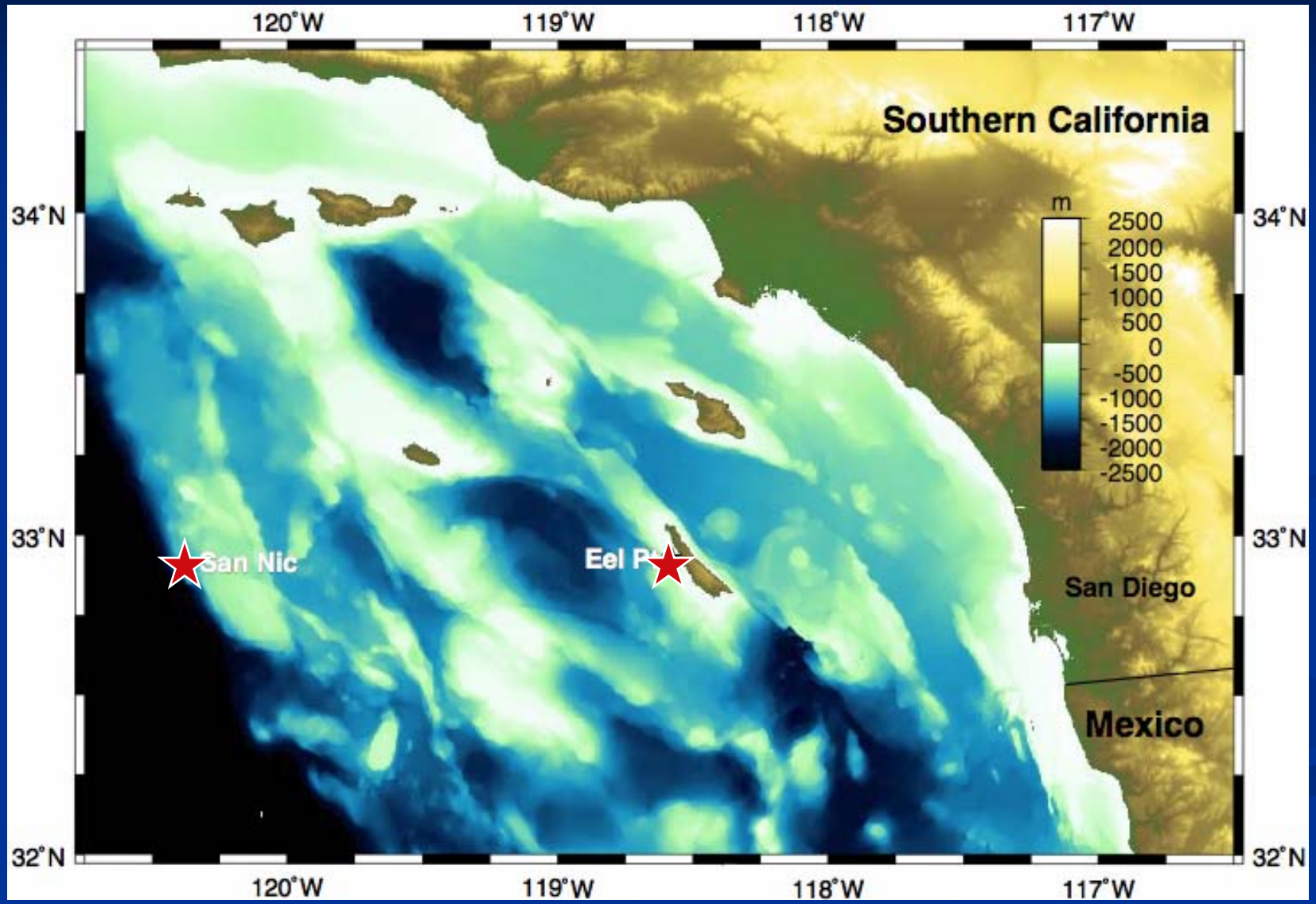


- Reduction of efficiency of hydraulic machinery
- Erosion produced by collapsing cavities

World Shipping Lanes

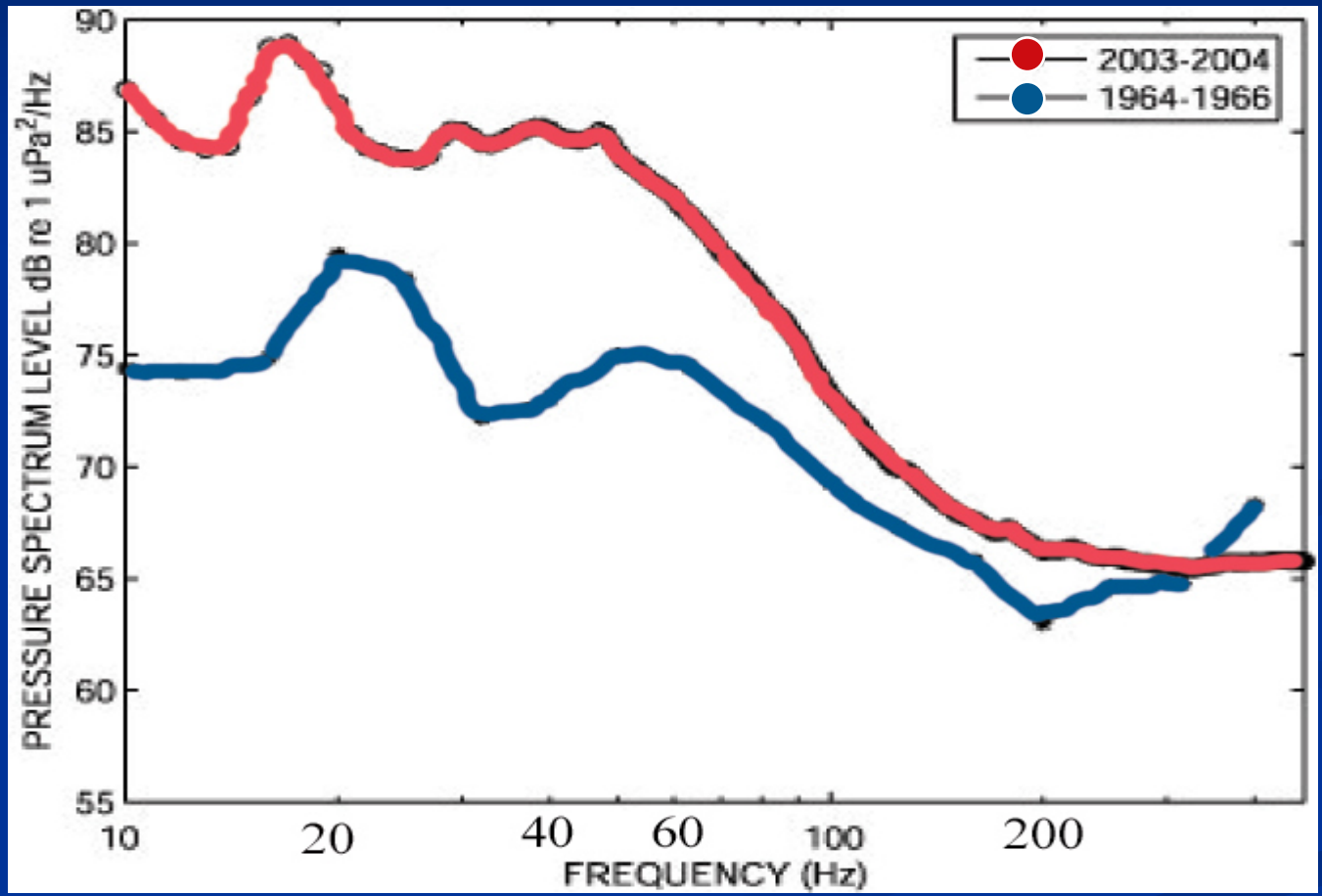


A Tale of Two Sites: San Nicolas and Eel Point



Ambient Noise – Deep Water Trends

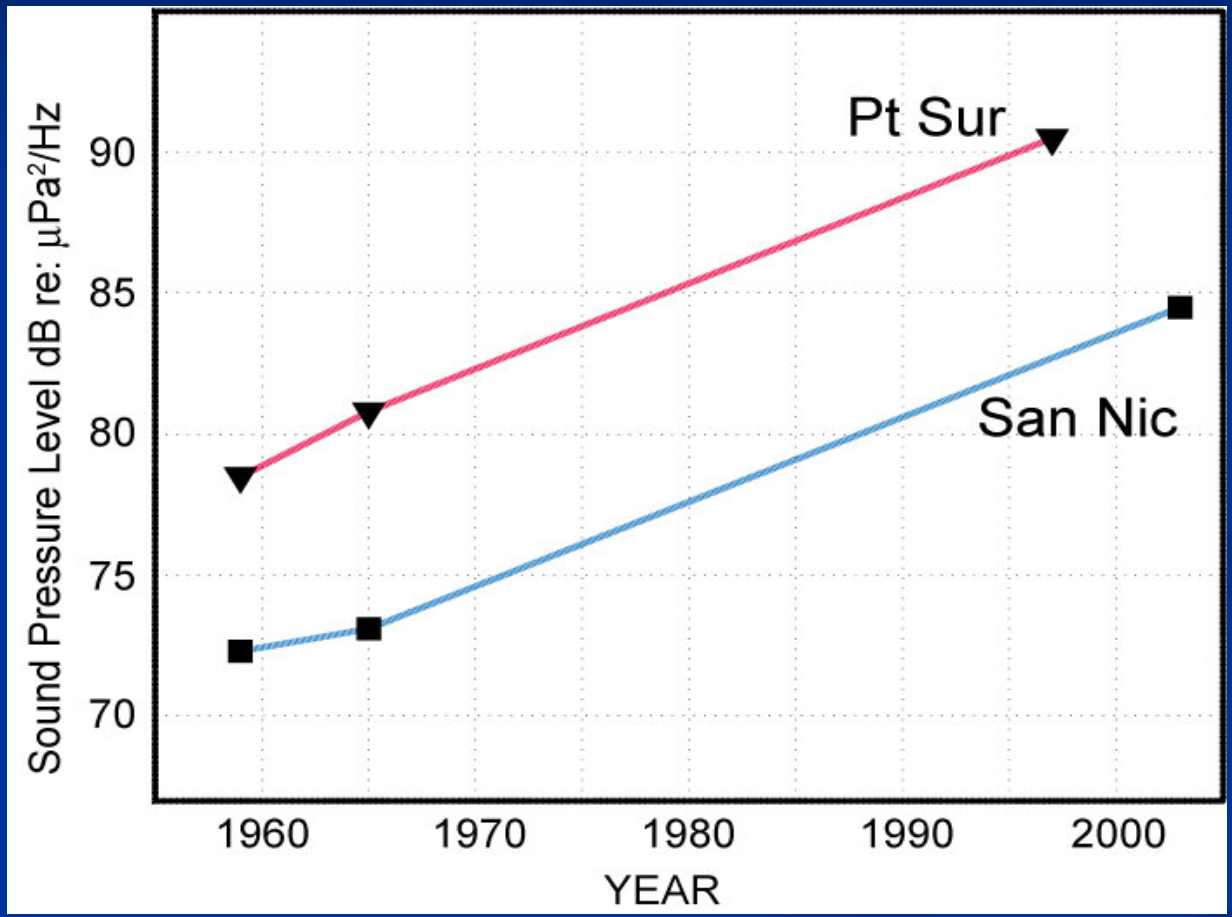
San Nicolas SOSUS Array – 1964 (Blue), 2004 (Red)



Shipping noise has increased ~3 dB/decade

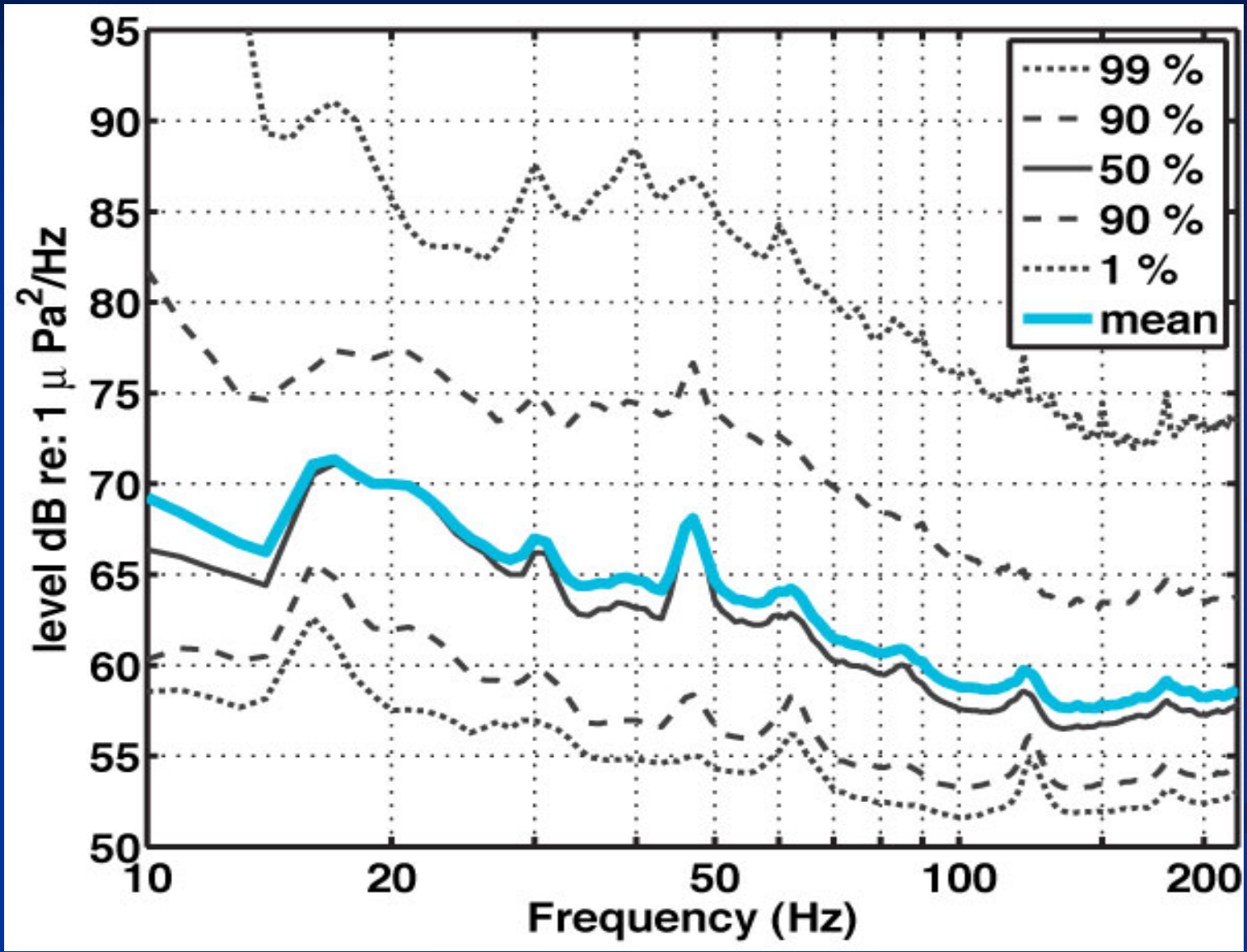
Ambient Noise – Deep Water Trends

North Pacific Ambient Noise at 40 Hz

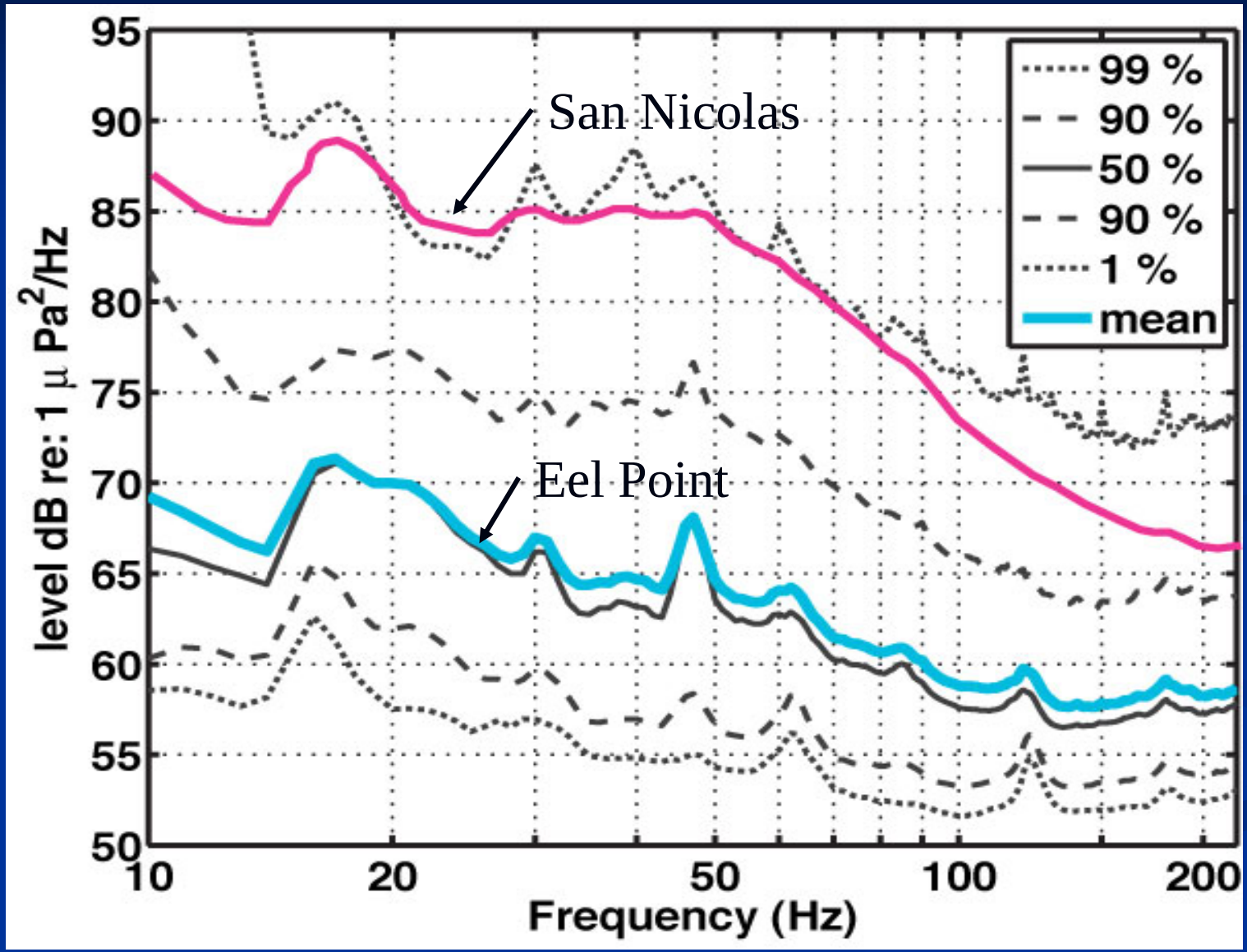


Shipping noise has increased ~3 dB/decade

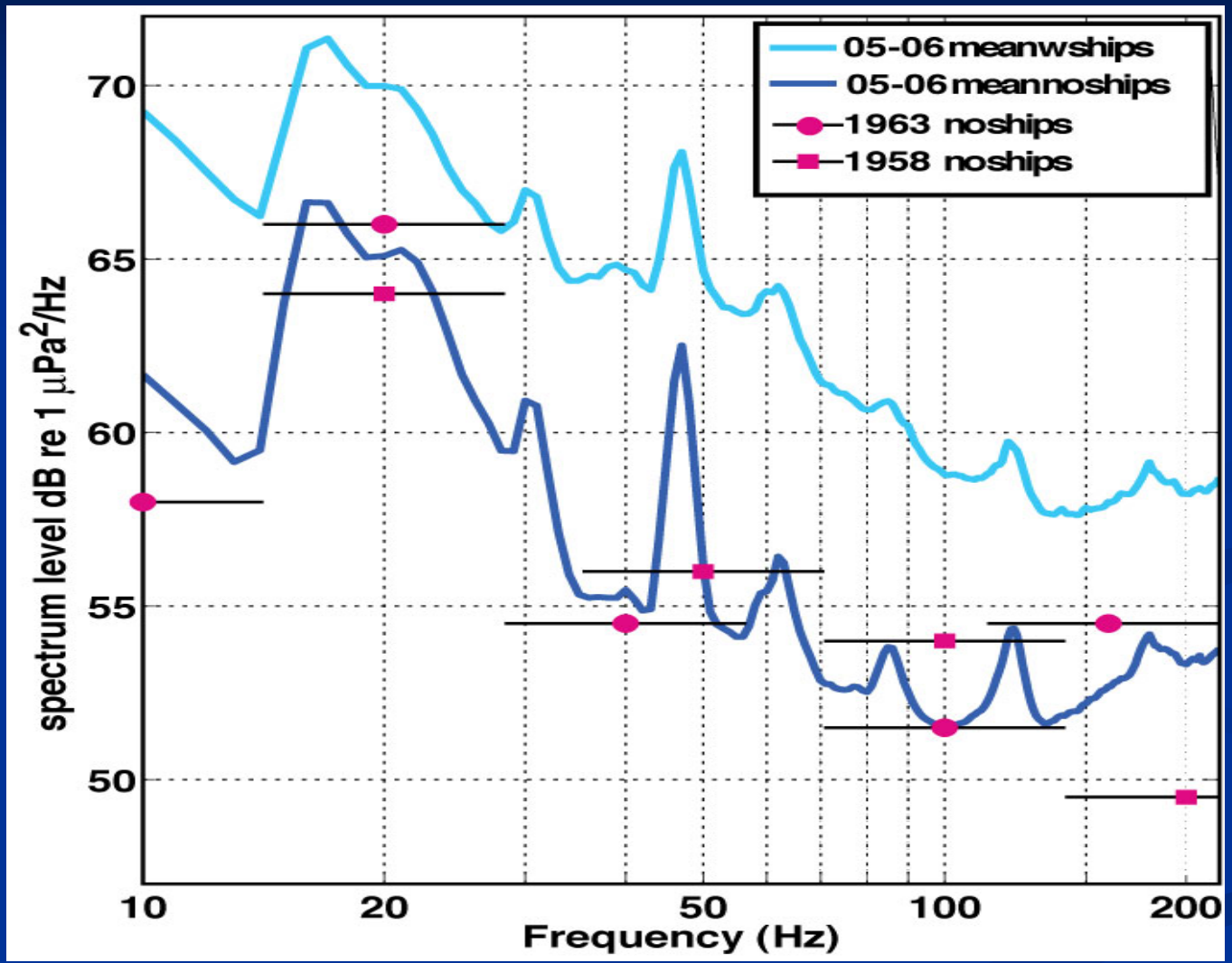
Shallow Water Noise Including Local Ships



Shallow Water / Deep Water Noise Comparison

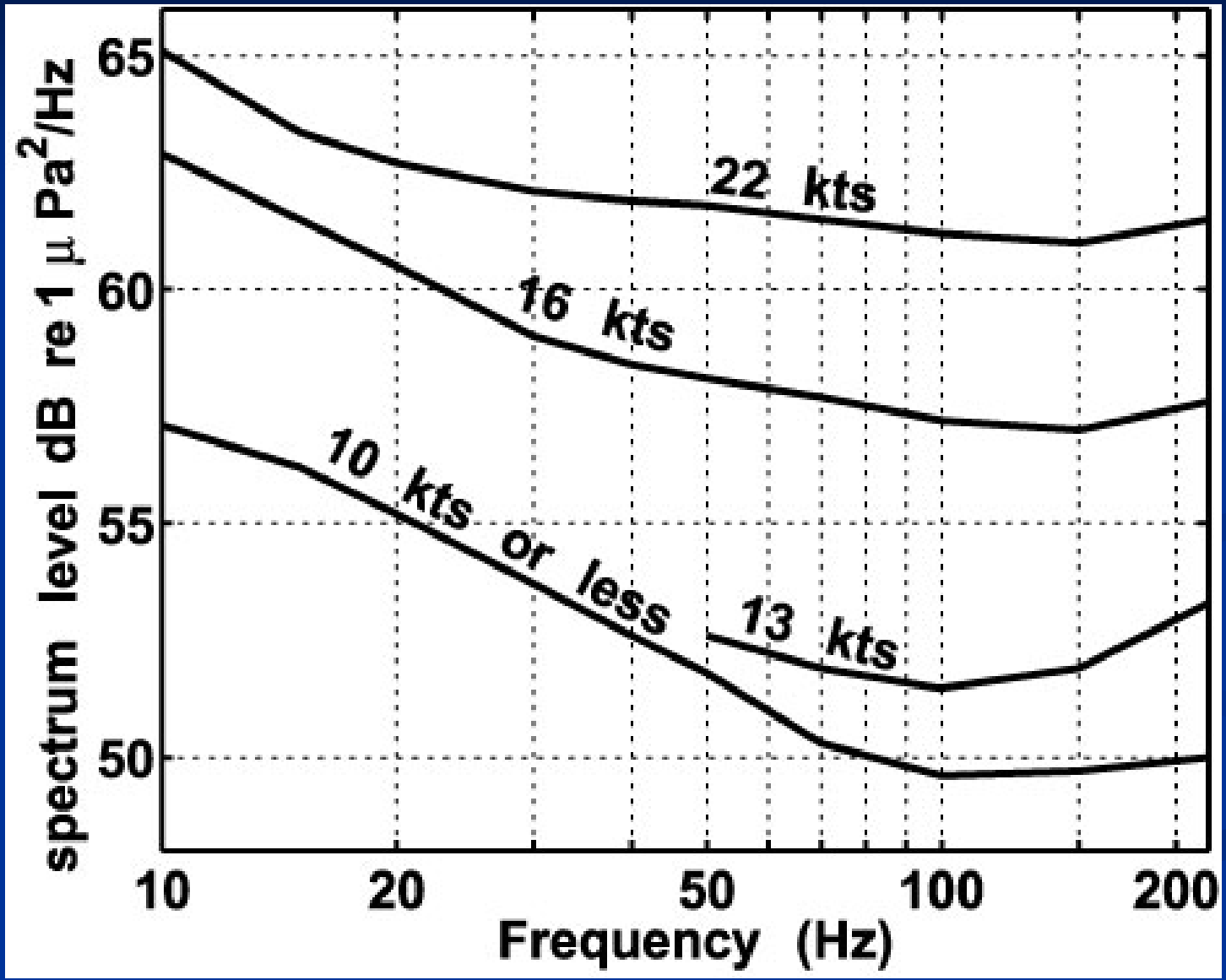


No Local Ships - NO CHANGE in 4 Decades

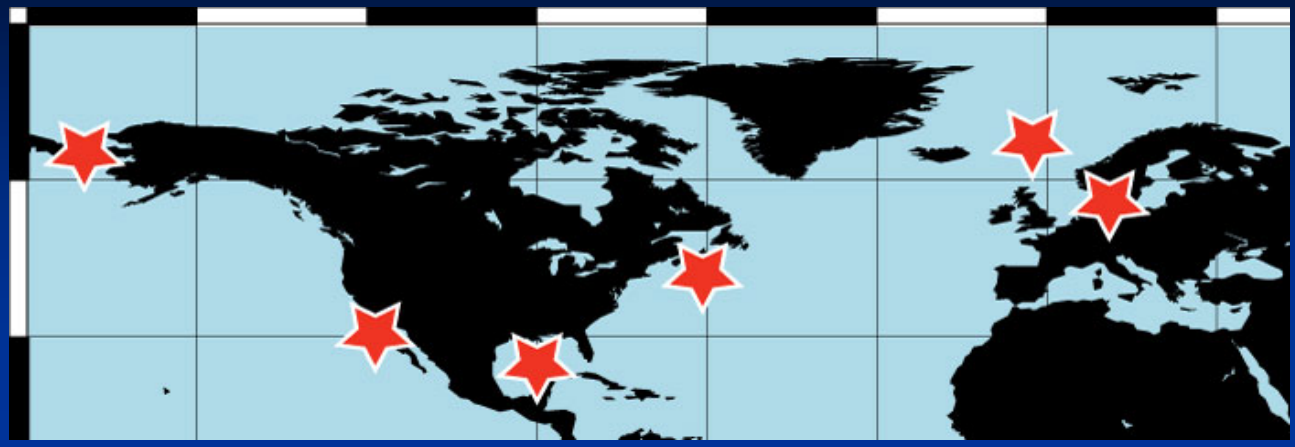


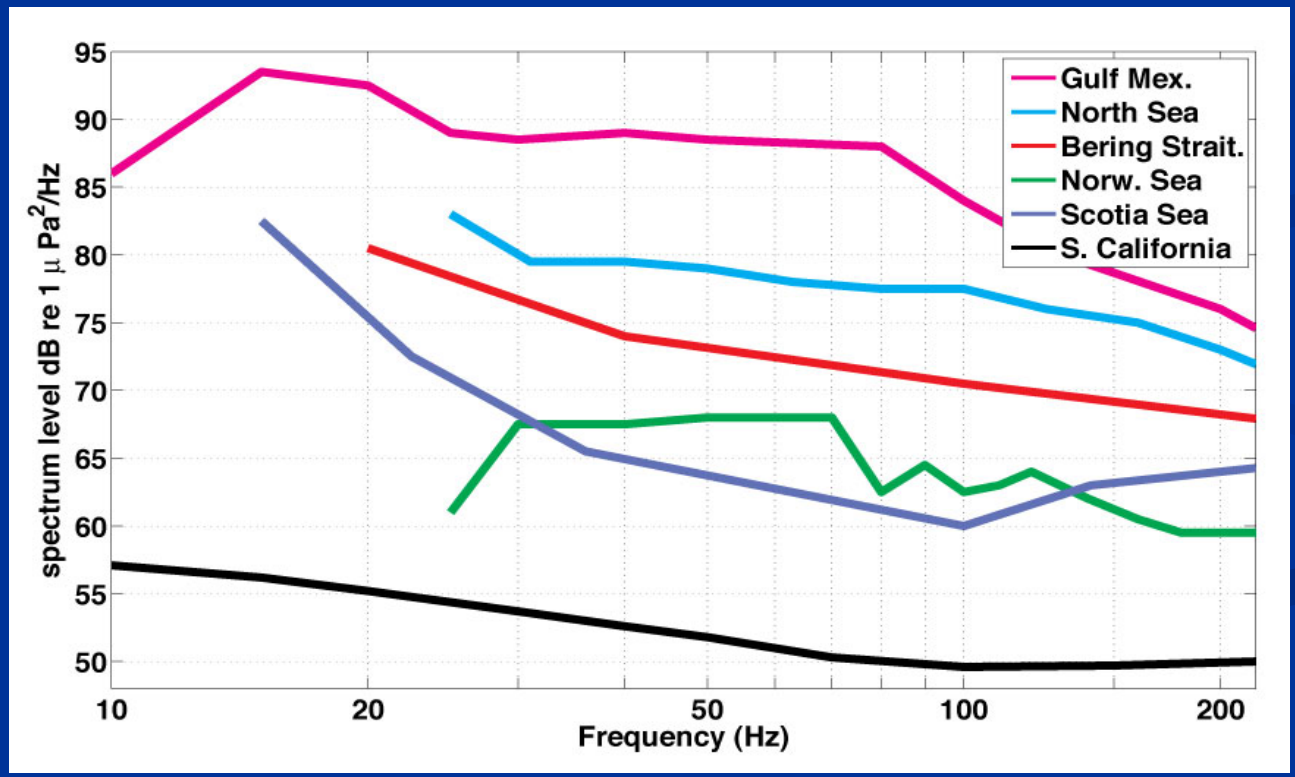
Shipping noise has increased ~1 dB/decade

Wind Dependence of Noise at Eel Point



Variability of Shallow Water Noise

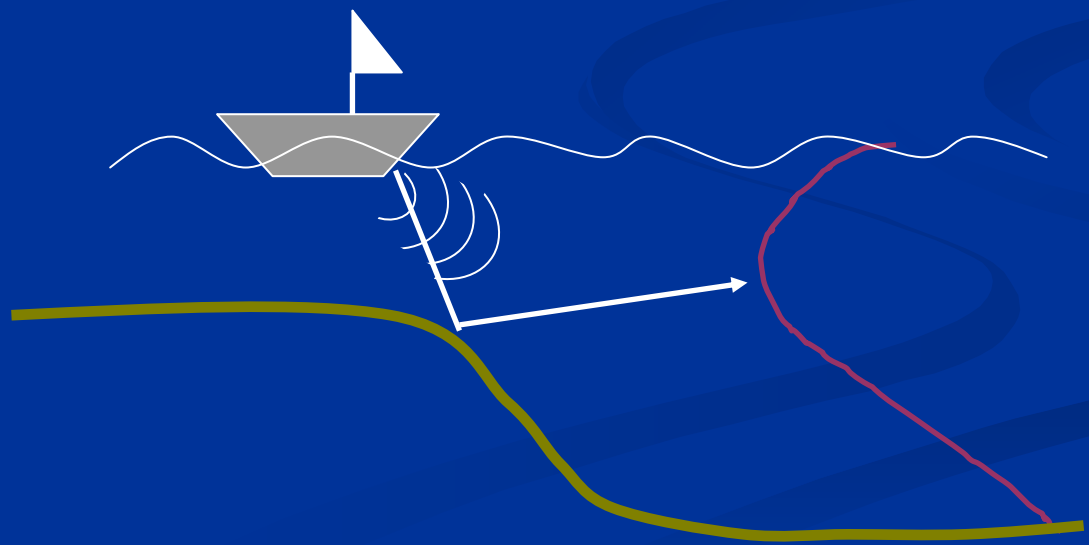




Propagation of Noise

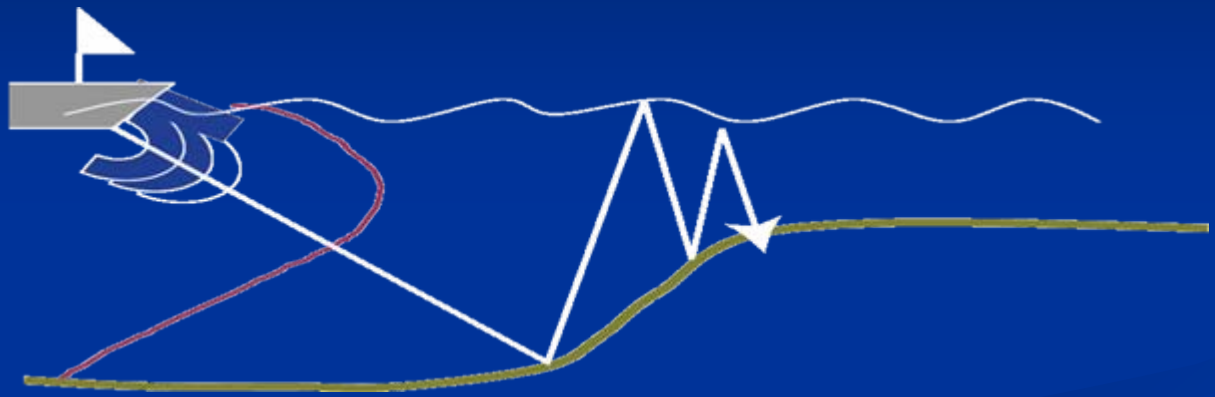
Shallow Water Continental Shelf

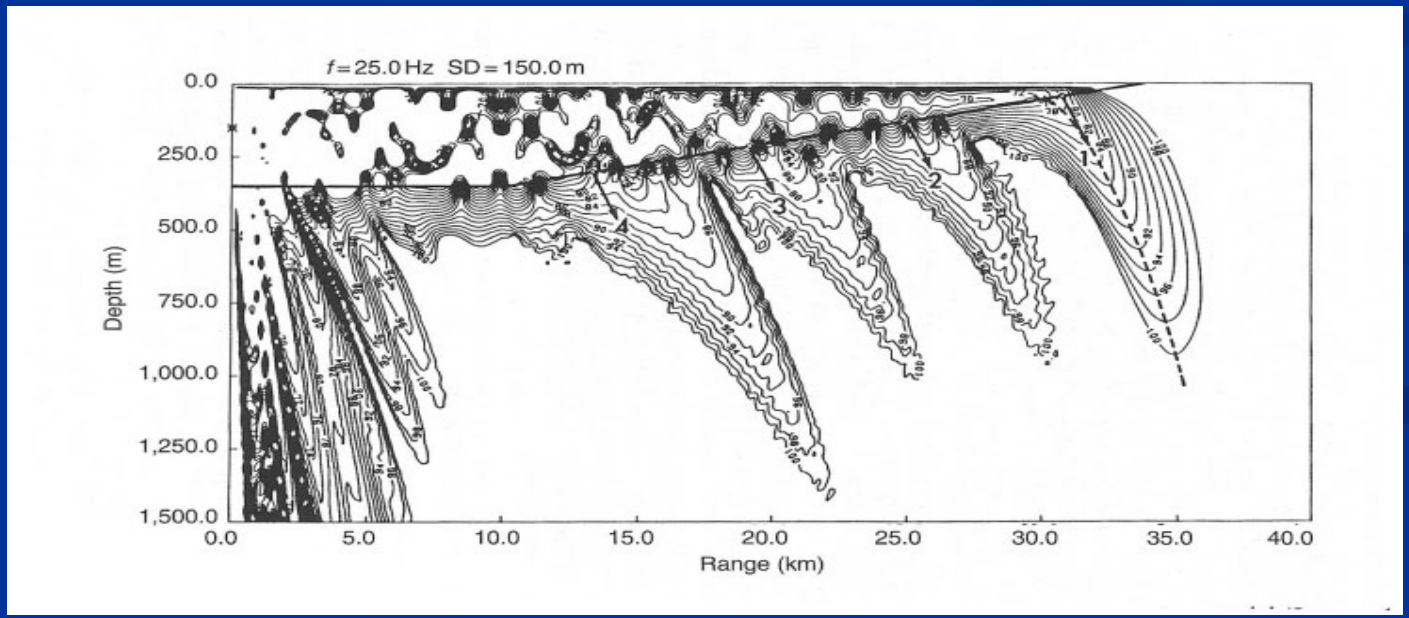
Down-slope Conversion of Sound to Deep Water



Propagation of Noise

Up-slope Transmission Loss of Sound from Deep Water





Conclusions

- **Deep Water Ambient Noise Increasing 3 dB per decade - Basin Wide Increases in Shipping**

- **Shallow Water Ambient Noise Increase Dependent upon Local Propagation and Local Shipping**