**Exercises**

1.Record a calibration signal with the pistonphone through the whole recording chain you are going to use for this practical.

2.Investigate the electric self-noise of the recording system you are going to use. Connect the whole recording chain while keeping the hydrophone on land, in an insulated box. Make a calibrated recording for further analysis below. *Make sure you use a hydrophone with very low electrical noise, such as the BK 8101 and Reson 4032, and have all recording gear connected to battery supplies to avoid electrical noise!* A few minutes of recordings should be enough for what you need for this practical.

3. Record the ambient noise in the ocean with as large bandwidth as possible. Each group should work at a different location and recording depth: Group 1: Close to shore, mid water column; Group 2: Close to the shore, close to the surface; Group 3: Close to the shore, close to the bottom; Group 4: Further out in the bay, mid water column; Group 5: Further out in the bay, close to the surface; and Group 6: Further out in the bay, close to the bottom

4. The ambient noise levels recordings are played back through an analog octave band and 1/3rd octave band filter. Measure the RMS level with an oscilloscope. Try to assess the variation in these measurements through picking 3 measurements at various times on the tape. Transfer the measurements to absolute sound levels with the help of the pistonphone calibration signal recorded on tape. Present the data both as the received ambient noise level as a function of frequency and also back-calculate to spectral noise density levels through subtracting 10 log (BW) for each frequency band. Compare the results to standard noise levels of deep oceans, given in the figure below. If you have time for it, also try to depict the variation (e.g. standard error) of your measurements for each frequency band).

5.Compare these noise levels with a similar assessment of the system noise that you recorded prior to the ambient noise recording (see 1. above).

6.Transfer some of the noise recordings to a computer. Use supplied computer routines to get the spectrum and apply different frequency resolution in the FFT. In which way does the size of the FFT analysis change the displayed level of the ambient noise? Can you figure out why? Calculate the spectral density of the ambient noise (1 Hz bandwidth) as well as the $1/3^{rd}$ octave band spectrum. Compare to the analogue measurements made above.

<u>Equipment:</u>
Hydrophone type: ______________________ Serial nr. ______________________
Pistonphone sound pressure level:__________ Pistonphone recorded voltage (mV): _______
Filters in the recording change:___________
Recording site: ______________________ Duration of recording:________________

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Draw a picture of the recording chain here:

Analogue measurements, 1/3 Octave Band measurements:

| **Frequency (Hz)** | **Level (mV)** | **Received Level (dB re 1 μPa)** | **BW(Hz)** | **Spectral noise density level (dB re 1 μPa2/Hz)** |
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**Octave Band measurements:**

| **Frequency (Hz)** | **Level (mV)** | **Received Level (dB re 1 μPa)** | **BW(Hz)** | **Spectral noise density level (dB re 1 μPa2/Hz)** |
|---|---|---|---|---|
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TS and Near field Practical

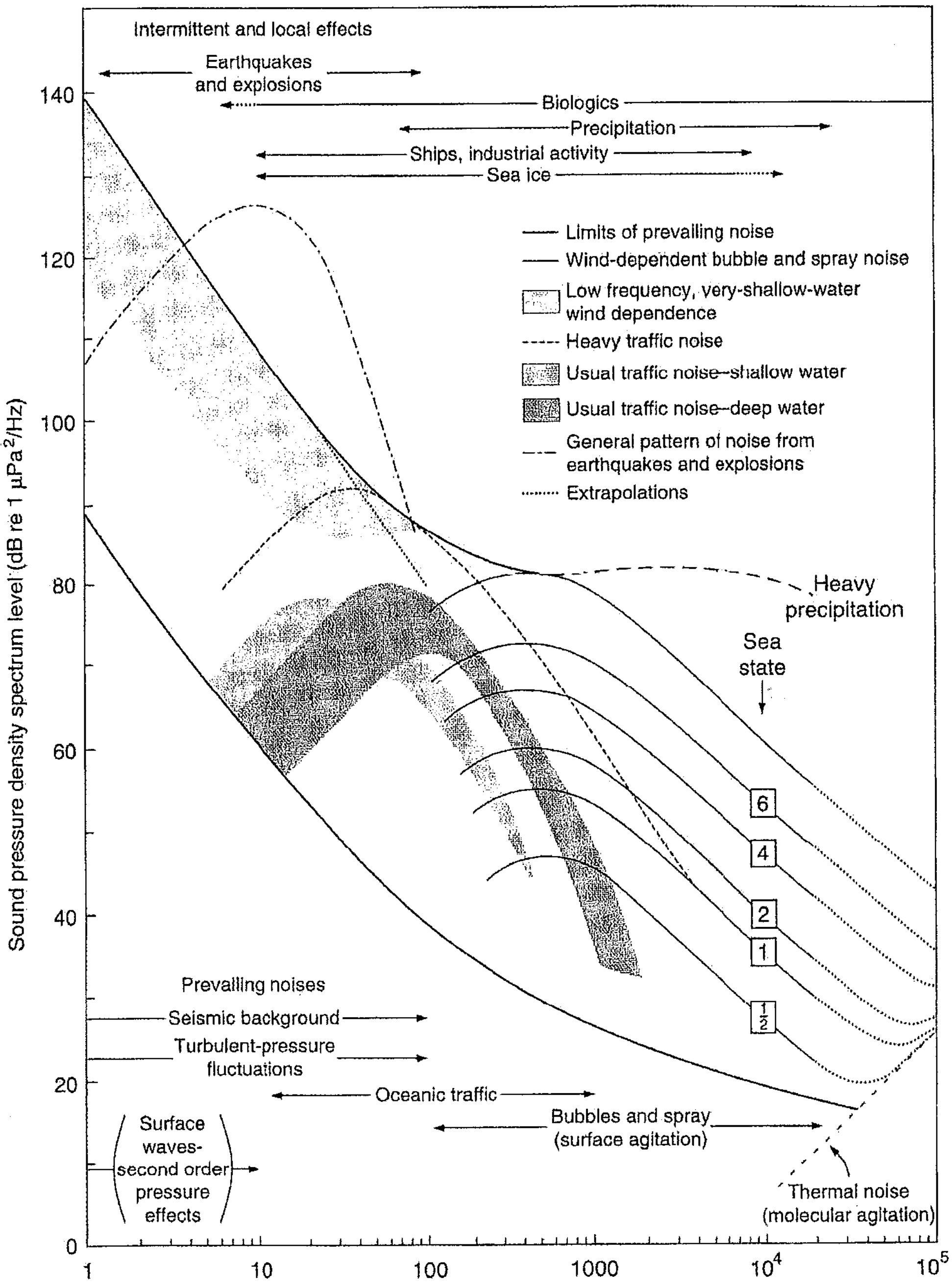


**Figure 1** *General types of natural and human-made sounds in the world's oceans (adapted from Wenz, 1962).*

From: Perrin (Ed) 2002. Encyclopedia of Marine Mammals, Academic Press, adapted after Wenz 1962, J Acoust. Soc. Am.