Snapping shrimp noise measured on the coasts of the Yellow Sea and the South Sea of Korea

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I. Introduction

The ambient noise in the ocean is dependent on marine life as well as wind, rainfall, snow, hailstorms and shipping. The sources of ambient noise in the deep ocean are clearly defined from the summary of a large amount of data measured in the 1940s [1]. According to this summary the main sources of ambient noise were distant shipping and ocean surface wind. The ambient noise in the coastal sea is more complicated than the noise in the deep ocean due to the breaking waves and marine life as well as shipping and wind. Because the biological noise due to the marine life has very high diurnal dependence and seasonal variation, it can more greatly affect on a change of ambient noise than the other sources [2]. It is well known that the noises of dolphins and snapping shrimp affect a sonar ping signal [2]. In the coastal sea where the snapping shrimp lives, its noise always exists with ambient noise such as shipping and wind noise. Therefore the snapping shrimp noise can exert more influence on the ambient noise and the sonar detection performance than dolphins. Because of this many researchers have measured and analyzed the snapping shrimp noise [2, 3]. In this study, we analyzed typical temporal waveform and frequency spectrum of the snapping shrimp noise measured at sites on the coasts of the Yellow Sea and the South Sea of Korea.

II. Experimental Measurements

The snapping shrimp noises at two sites on the coast of the Yellow Sea and the South Sea of Korea were measured for 30 minutes at 3-hour intervals throughout 24 hours. The snapping shrimp noise received by a hydrophone was amplified through an acoustic measuring amplifier (Bruel & Kjaer, Type 2636) and then was recorded in a tape recorder (SONY, PC208Ax). The water depths at sites on the coasts of the Yellow Sea and the South Sea were 25 m and 35 m, respectively. Therefore, hydrophones (Bruel & Kjaer, Type 8101) at each site were located at depths of 20 m and 25 m from sea surface, respectively.

III. Results

Figure 1 shows typical temporal waveform and time-frequency spectrogram of the snapping shrimp noise. The waveform has a positive broad peak at initial time and a negative narrow peak after that time, and its spectrogram shows very broadband frequency response up to about 60 kHz. Peak-to-peak pressures of the shrimp noise measured on the coasts of the Yellow Sea and the South Sea were about 17.5 Pa and 22.5 Pa, respectively. If each shrimp were directly under each hydrophone, source levels of the peak-to-peak pressure of the shrimp noise measured on the coasts of the Yellow Sea and the South Sea were about 157 dB and 166 dB re 1 μPa at 1 m, respectively. Here, spherical spreading was considered and acoustic absorption was neglected. The spectrogram in Figure 1 also shows that acoustic energy of the snapping shrimp noise was concentrated below 20 kHz. Figure 2 and Figure 3 show average ambient noise level and its diurnal variation measured between 1 and 20 kHz during one day on the coasts of the Yellow Sea and the South Sea, respectively. The snapping shrimp noise on the coasts of the South Sea significantly affected the ambient noise between 2 and 20 kHz and it was also very dominant at midnight and early morning in diurnal variation. However, the snapping shrimp noise on the coast of the Yellow Sea weakly affected the ambient noise and it did not almost affect the diurnal variations of the ambient noise.

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IV. CONCLUSIONS

The acoustic characteristics of the snapping shrimp noise at sites on the coasts of the Yellow Sea and the South Sea of Korea were investigated. The snapping shrimp noise affected the ambient noise in the frequency range from 2 to 20 kHz. It was more significant on the coast of the South Sea than on the coast of the Yellow Sea. This means that the distribution density of the snapping shrimp at the site in the South Sea is higher than that in the Yellow Sea.

REFERENCES

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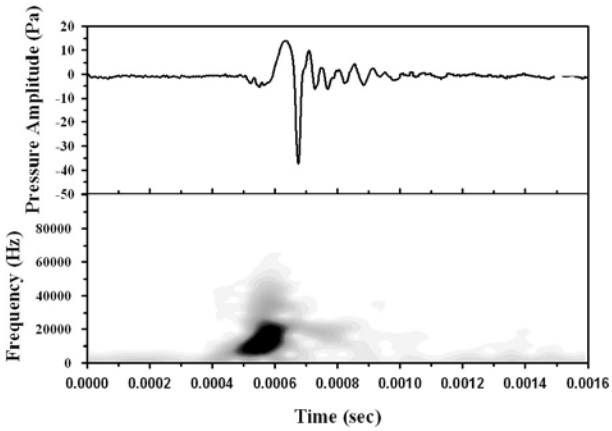

Figure 1. Typical temporal waveform and spectrogram of the snapping shrimp.

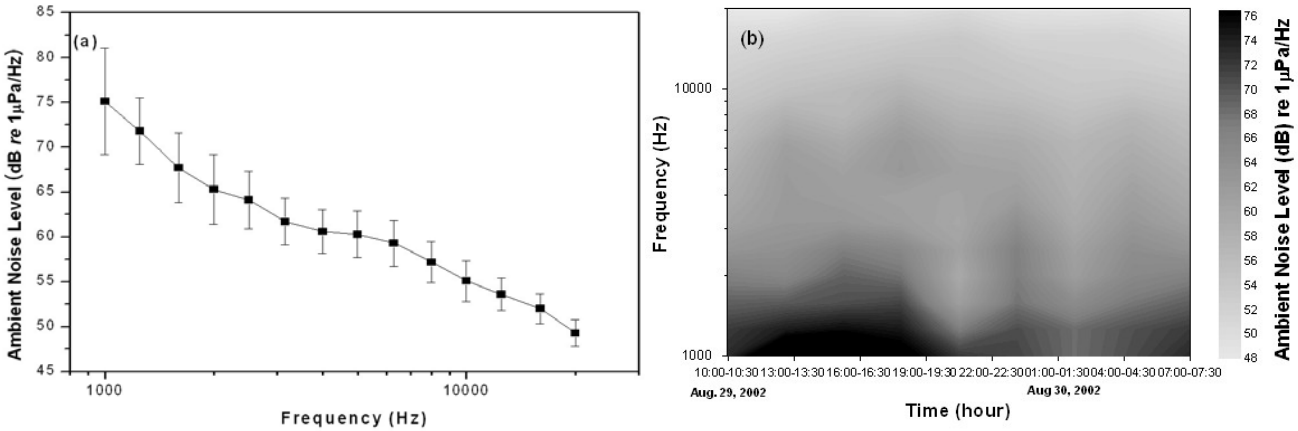

Figure 2. (a) Average ambient noise spectrum level and (b) its diurnal variation measured between 1 and 20 kHz at site in the Yellow Sea of Korea.

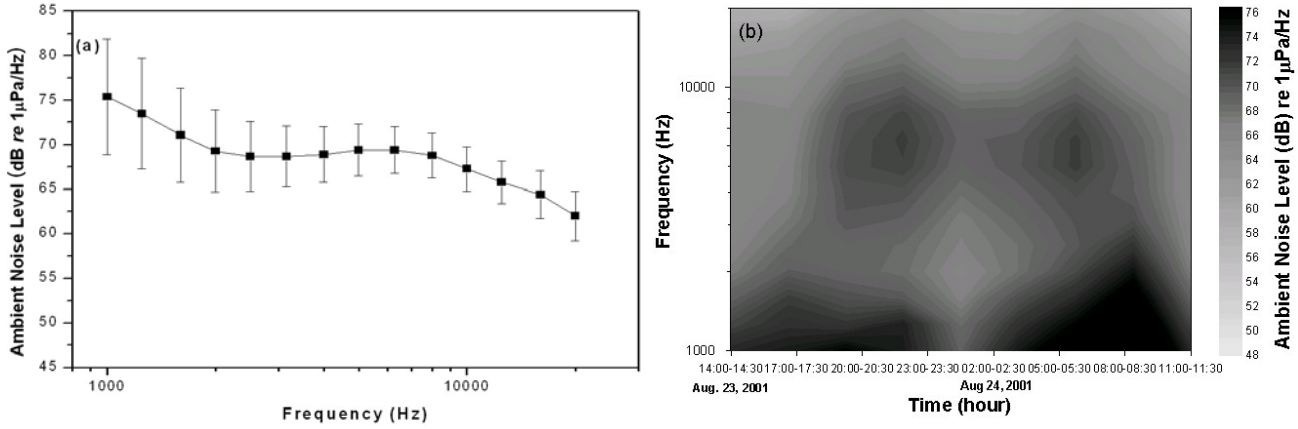

Figure 3. (a) Average ambient noise spectrum level and (b) its diurnal variation measured between 1 and 20 kHz at site in the South Sea of Korea.