

# Ambient noise measurements in the Sea of Japan (East Sea)

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## ABSTRACT

Ambient noise signals were extracted during a pilot experiment in the Sea of Japan (also called East Sea) from September 11 to October 23, 1999, to assess the possibility of using acoustic tomographic techniques for the monitoring of water mass structure and dynamics. The measurement system consisted of a vertical line array with 10 elements (spaced 10 m apart) distributed throughout the water column (290~380m). The system was deployed off the north coast of Ulleung-do Island (South Korea). The recorded signals were transmitted to a receiving station at a radio frequency of 162.25 MHz. Approximately 2 days worth of data were processed in 1-Hz and 1/3-octave bandwidths from 200 to 500 Hz, to characterize depth dependence, noise levels, and noise source. Ambient noise spectrum levels varied over a range of 60 ~ 80 dB//1 uPa//1 Hz for 200~500 Hz and showed no depth dependence. The levels were relatively high during the early morning hours (3~5 AM), about 5~10dB greater than at other periods, presumably due to high fishing activities.

## 1. INTRODUCTION

Generally, the sources of ambient noise are various and diverse. These sources are divided arbitrarily into five frequency bands. In each of these bands the current sources of ambient noise appear to be different. Intense ambient noise is measured in areas of high ship activity at frequencies of 50~500 Hz. The radiated noise from ships is also a major source of noise in this frequency region. Machinery and propeller noise dominates this spectrum of frequencies and their intensity depends upon ship activities such as speed, ship density, frequency, and depth [1, 2].

Here, we discuss the characteristics of ambient noise spectra at frequencies of 200 to 500 Hz in the Sea of Japan (East Sea) and characterize their depth dependence, time variation, and origins.

## 2. MEASUREMENTS OF AMBIENT NOISE

Ambient noise signals were extracted from the data of a pilot experiment that was conducted in the Sea of Japan from September 11 to October 23, 1999. The vertical line arrays were deployed near Ulleung-do (37°32'34.6" N, 130°46'16"W), with 10 hydrophones spaced 10 m apart, spanning a

depth range of 290~380 m, the uppermost at a depth of 418 m [3].

The VLA recording systems were made at a sampling rate of 1464 Hz from Oct. 20 to 22 (about 47 hours). To avoid radio frequency, we selected 9600-s (about 22 hours) of the data that were extracted from recording signals with 366-Hz transmitted signals. Depth dependency and time variation of the data was determined by analyzing 60-s average spectra in 1/3 octave bands and 1 Hz bins, respectively.

## 3. RESULTS

Ambient noise signals obtained during the 12-day experiment were analyzed. Data collected by 10 elements of the VLA show no depth dependency in terms of coherence between elements throughout the recording period.

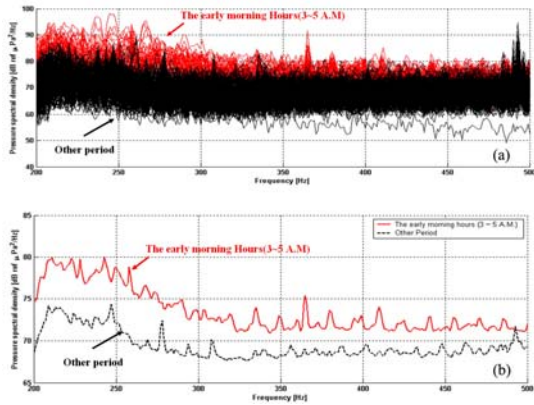


Fig. 1. Pressure spectrum levels (1 Hz bins) at 200 ~500 Hz for the early morning period 3~5 AM (red solid line), compared with that of other periods (black dashed line). (a) Represents the whole pressure spectrum level, and (b) are the mean values from each period.

Ambient noise spectrum levels varied over a range of 60~80 dB//1 uPa//1 Hz for 200~500 Hz. Average pressure spectrum levels for the recorded 2 hours from 3 to 5 AM were increased over whole frequencies, when compared with averages recorded in other periods (Fig. 1). The 3~5 AM noise levels at frequencies 200~500 Hz were 5~10 dB higher. While fishing, fishing boats use an electrical generator for the light and hoist systems without engine noise.

However, when they started returning to the port at daybreak after the night-fishing activities, they may created a higher ship-radiated noise level.

According to a report on fishing conditions, there were several fishing boats catching cuttlefish near the experiment site [4].

The levels were relatively high during the specific hours (3~5 AM), about 5~10 dB greater than at other periods. We can guess that the fishing boat presumably created high radiated-noise to return to the port at that time.

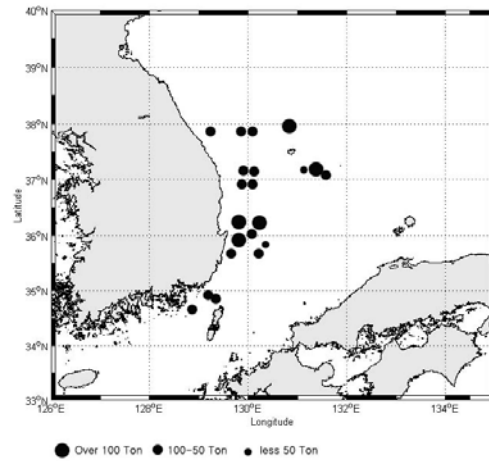


Fig. 2. Location of cuttlefish fishing sites and amount of fish caught during the period of experiments [4].

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