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Acoustic Monitoring of Fish Activity around an Artificial Reef in South Sea, Korea

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1. Introduction

Artificial reefs (AR) are used to promote fishery resources because it provides a habitat for marine life including fishes in coastal region.[1–2] Although several types of AR h bave been built in coastal regions, few studies have been conducted to investigate the distribution and abundance of fishes around the AR.[3–4] It is necessary to monitor the long-term change of ecosystem around the areas where the ARs were deployed.

In this paper, an acoustic method is used to examine the daily variability of the distribution of fishes around the AR.

2. Materials and Methods

Acoustic system was deployed in coastal water (about 27 m deep) of the South Sea, Korea (34° 46.200′N, 128° 22.980′N) by the Korea Institute of Ocean Science and Technology (KIOST) where the pyramid-typed AR has been built. The dimension of the AR was 7 m × 7 m × 7 m and the material was steel (**Fig. 1**).

The Acoustic system consisted of a 125-kHz acoustic zooplankton fish profiler (AZFP, ASL Environmental Sciences Inc., Victoria, British Columbia, Canada) and a current meter (AquaDopp, Nortek AS, Vangkroken 2, Norway) which has a built-in temperature sensor (**Fig. 1**).

The AZFP was located 28 m away from the AR. 0.2-ms acoustic signal with a center frequency of 125 kHz was used as a source signal. The signal was transmitted for 50 times and ensemble averaged, which was repeated every 5 min. The acoustic measurements were conducted for 14 days from September 1 to 14, 2013. The received acoustic signals were converted to volume backscattering strength (S_V, dB re 1 m^{-1}). During the acoustic measurements, the current velocity averaged for 1 min and the water temperature were measured every 5 min.

The tidal periods at the mooring location were extracted from the database of the Korea Ocean Observing and Forecasting System (KOOFS, http://sms.khoa.go.kr). The dominant species of fish around the AR during the measurements were rock fish, *Sebastes schegeli*, which was evaluated by an underwater camera.

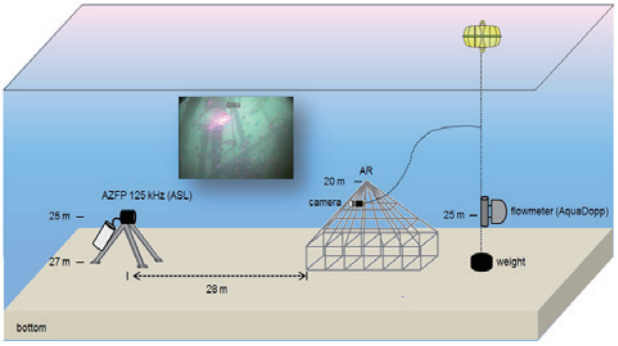

Fig. 1 Design of Acoustic mooring system. AZFP: acoustic zooplankton fish profiler, AR: artificial reef.

3. Result and Discussion

Fig. 2 shows an echogram for S_V measured for 3 days from September 1 to 3. The echos from the fish aggregation and AR are clearly resolved. The strong S_V were observed between 15 m and AR in daytime, exhibiting a range of S_V of –75 to –32 dB, whereas S_V in nighttime were relatively low.

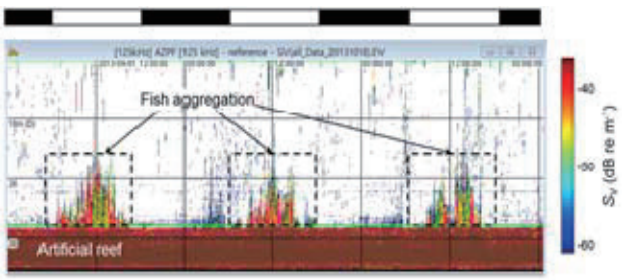

Fig. 2 An example S_V echogram for fish aggregation at 125 kHz AZFP.

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Fig. 3 shows the echograms for 14 days. Each echogram shows the variability of S_V for 24 hours as a function of range from a transducer. Strong volume backscattering strengths near the AR were measured only during daytime, which happened once a day from September 1 to 8 and twice a day after September 9. The results indicate that fishes inhabiting the AR are actively moving during a specific time period.

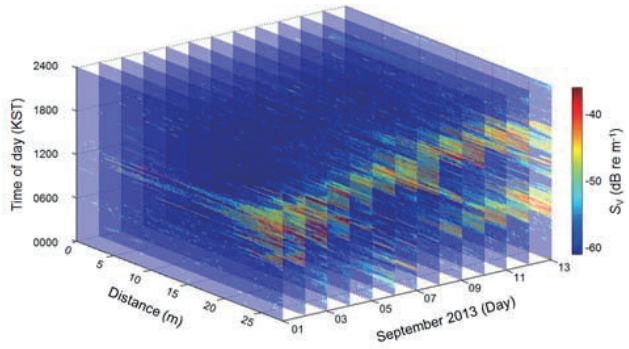

Fig. 3 Data cube showing a 14 day segment of time series of 125 kHz backscattering near the artificial reef in coastal of South Sea, Korea.

Fig. 4(a) shows a graph of tidal height during the period of measurements, and **Fig. 4**(b) shows the echogram as functions of distance from the transducer and time. The time when strong volume backscattering strengths were observed are corresponding to the time of neap tide during daytime.

In conclusion, the activity of fishes inhabiting the AR seems to be greatly influenced by both light and tidal height.

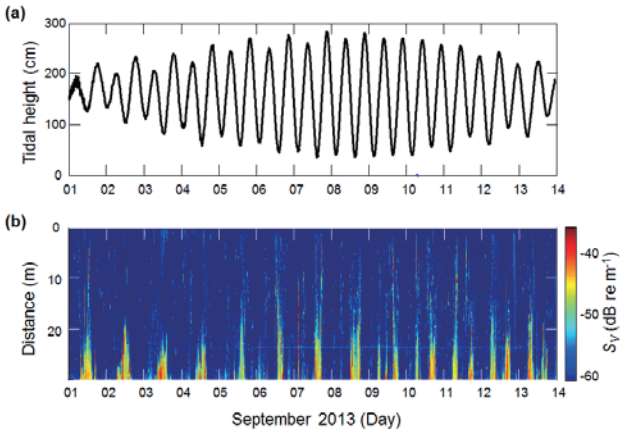

Fig. 4 Temporal variability in acoustic backscattering and related environmental parameter: (a) Tidal height; (b) Volume backscattering strength (dB);

Acknowledgment

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